2007 Trends in Trauma and Emergency Medicine

An annual data report by
the Medical Informatics Program in
the Division of Trauma/Critical Care

Virginia Office of Emergency Medical Services

Virginia Office of Emergency Medical Services
Virginia Department of Health
www.vdh.virginia.gov/oems

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HIPAA and Submitting Data to the Office of Emergency Medical Services

Why is public health data collected?

The Virginia Department of Health (VDH), Office of Emergency Medical Services (OEMS) is charged with protecting the health of all citizens and visitors of Virginia. As with any local, state, or federal public health authority, VDH/OEMS recognizes the importance of collecting and sharing protected health information (PHI) to accomplish essential public health objectives.

Public health practice and research, including such traditional public health activities as program operations, public health surveillance, program evaluation, terrorism preparedness, outbreak investigations, direct health services, and public health research, use PHI to identify, monitor, and respond to disease, death, and disability among populations. The *Code of Virginia* specifically requires OEMS to collect data on the incidence and severity of injury and illness to improve pre-hospital and hospital emergency medical services.

Does HIPAA apply when submitting data to OEMS?

NO. OEMS, as a public health authority, as defined by the Health Insurance Portability and Accountability Act (HIPAA), Standards for Privacy of Individually Identifiable Health Information; Final Rule 45 CFR §164.501 of the *Code of Federal Regulations* (CFR) does not fall under the rules of HIPAA. OEMS collects patient identifiable information through its statewide trauma registry and EMS registry (PPCR) as a public health activity as described by 45 CFR § 164.512(b), and is authorized by §§ 32.1-111.3, 32.1-116.1 of the *Code of Virginia* and by 12 VAC 5-31-560 of the Virginia Administrative Code.

Public health authorities have a long history of protecting and preserving the confidentiality of individually identifiable health information. With OEMS' Trauma and EMS Registries, multiple laws and regulations require the protection of an individual patient's privacy. 12 VAC 5-31-530 of the EMS Regulations requires the securing of all records maintained by EMS agencies. *Code of Virginia* Sections §§ 32.1-116.1, 32.1-116:1, 32.1-127.1:03 also provide detailed information about the protection of PHI and related directly to data collected by OEMS.

What is identifiable information and why is it collected by public health authorities like OEMS?

Identifiable patient information are those data items that can be used to individually identify a person. This would include the patient's social security number, patient residence (city, county, FIPS code, and Zip code), and date of birth (DOB). Even though HIPAA does not apply to submitting data to public health authorities, such as EMS or trauma data being submitted to OEMS, HIPAA understands the importance of collecting public health data and 45 CFR § 164.506 clearly states that where data submission is required by state law or regulations, such as EMS data, it is permissible.

Identifiable data, such as submitting data with social security numbers and dates of birth, is essential to put EMS data to work. As OEMS plans to move towards a new EMS data collection system, the EMS Registry, a major goal with this project is to tie EMS data to the statewide trauma registry, hospital discharge information, the Department of Motor Vehicles' law enforcement crash reports and more. The benefits of tying EMS data to trauma registry and hospital data is that it will allow us to measure the effectiveness of care that EMS providers provide, otherwise known as "outcomes". This form of evidence based practice is one of the goals stated in the recent Institute of Medicine (IOM) report "*Emergency Medical Services at the Crossroads*".

More information on HIPAA as well as the data used in this report, can be found on the OEMS website: http://www.vdh.virginia.gov/OEMS/

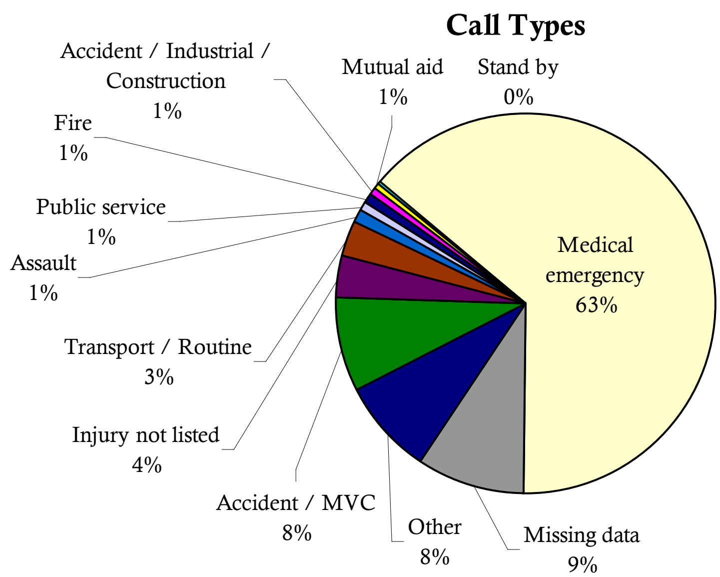
EMS Call Types

OEMS receives approximately 200,000 records per quarter from agencies across the state. Nearly 650 agencies are required by the *Code of Virginia* to submit data to OEMS on all incidents with the exception of scheduled inter-facility ground transfers. Data is due to OEMS on the last day of the following month. Data for the 4th quarter of 2007 was due on January 31, 2008.

OEMS offers a free software program that allows agencies to submit via a secure web portal. Agencies may also choose to send their data to OEMS via CD or disk. However, this method is decreasing as agencies recognize the ease of submitting via the web.

Call Types

Call Type	Frequency
Medical emergency	529,755
Missing data	75,483
Other	66,135
Accident / MVC	65,851
Injury not listed	31,966
Transport / Routine	23,589
Assault	11,041
Public service	6,604
Fire	6,311
Accident / Industrial / Construction	4,777
Mutual aid	4,376
Stand by	2,088



Literature Brief

Pre-hospital prediction of the severity of blunt anatomic injury

Journal of Trauma, March 2008

Summary:

The purpose of this study was:

1. To evaluate the ability of paramedics to predict patients requiring a major trauma service;
2. To assess whether paramedic prediction of severity of injury to individual body regions is accurate and could add to overall paramedic prediction of injury severity.

Paramedics prospectively recorded the severity of injury to the head, thoracic, and abdomen regions, and whether the patient required a major trauma service, for primary response adult (>15 years) trauma patients. Paramedic predictions of injuries were compared with patient outcomes.

The paramedics correctly categorized all patients who were admitted to an intensive care unit, required urgent surgery, or died in hospital as major trauma. Paramedic predictions of injuries were compared with patient outcomes and results found that paramedics were unable to reliably identify severe injury to individual body regions. In addition, assessment of the severity of injury to individual body regions did not appear to improve accuracy.

EMS Demographics

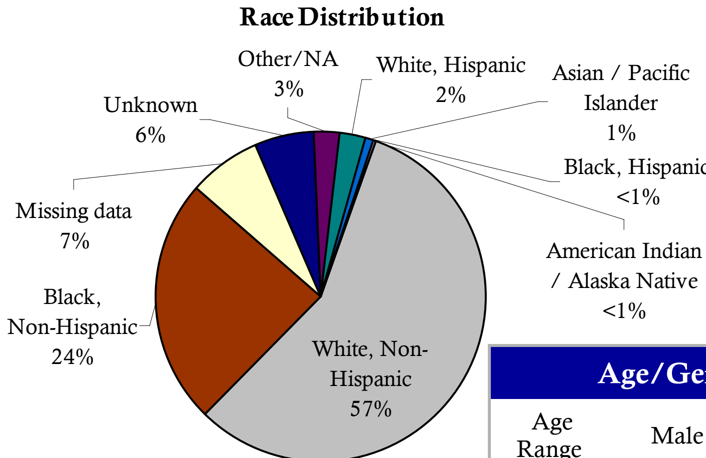
Demographic summaries on this page, include all incident dispositions except those with a disposition of: *no treatment required, patient refused care, cancelled, or no patient found.*

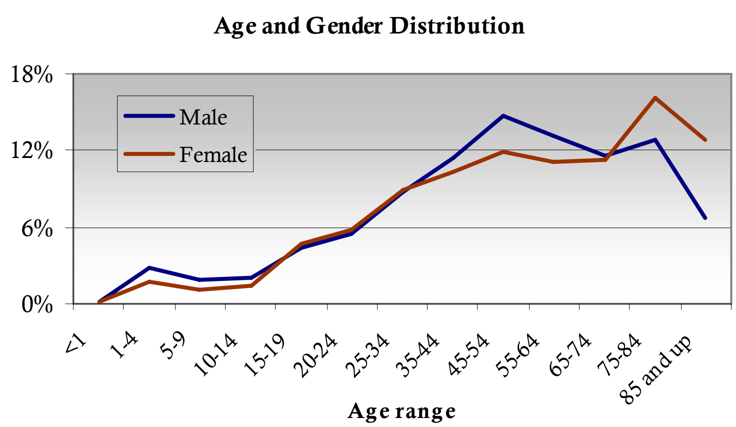
According to the 2006 US Census projections, Virginia is comprised of 67% white non-Hispanic and 19% black non-Hispanic persons (2007 predictions were not available at time of writing). This distribution coincides with that of the population served by the Virginia EMS system. As the chart below demonstrates, white non-Hispanics were the largest group at 57%, with black non-Hispanics being the second largest group at 24%

It is important to note that PPCR data is not complete with regard to the race variable. 13% of cases were either missing or marked as “unknown”. As OEMS moves forward with its new EMS Registry, there will be upfront validations in place to aid in acquiring this extremely important variable.

Race

Race	Frequency
White, Non-Hispanic	364,101
Black, Non-Hispanic	155,560
Missing data	48,054
Unknown	36,296
White, Hispanic	14,954
Other / NA	9,886
Asian / Pacific Islander	5,055
Black, Hispanic	2,059
American Indian / Alaska Native	463





Age/Gender

Age Range	Male	Female
<1	498	463
1-4	7,226	5,501
5-9	5,019	3,583
10-14	5,457	4,674
15-19	11,477	14,909
20-24	14,025	18,379
25-34	22,882	28,180
35-44	29,405	32,735
45-54	38,218	37,953
55-64	34,081	35,084
65-74	29,811	35,762
75-84	33,059	51,263
85 and up	17,335	40,886

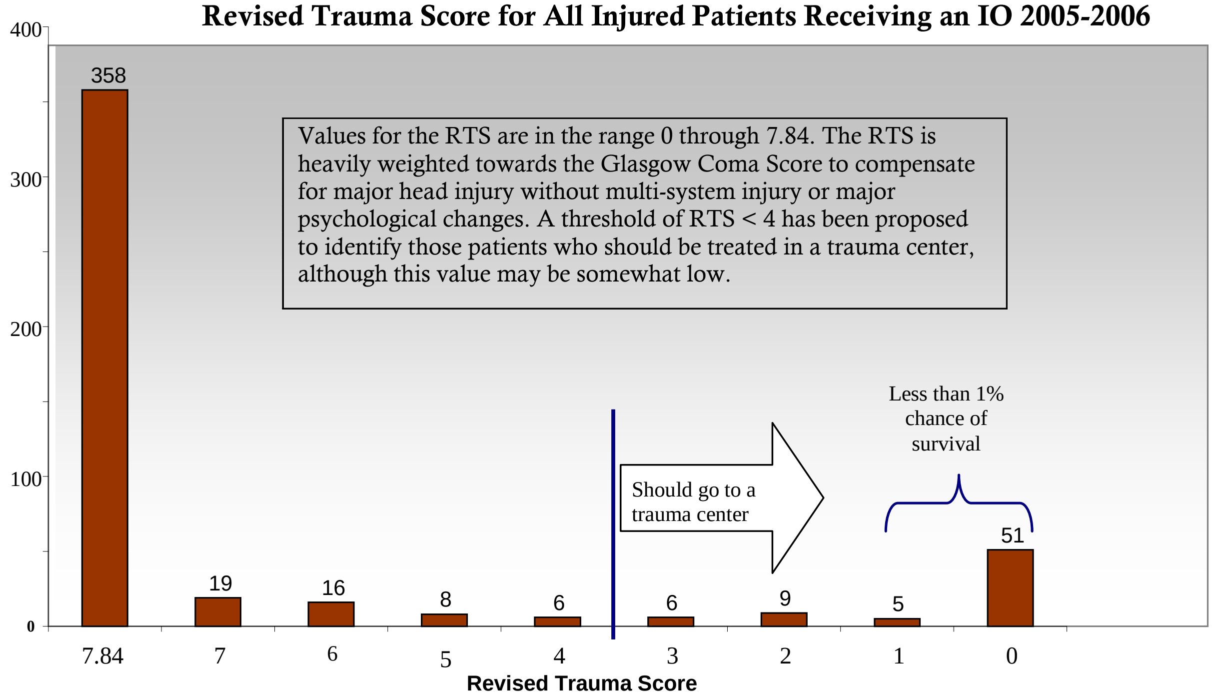
EMS Use of Intraosseous Access

Intraosseous devices (IO) traditionally have been limited to the pediatric population; however, with the increasing technology in adult IO devices, the trend to use IO in non-trauma and non-cardiac arrest patients is growing. Utilization of IO's in Virginia is increasing every year, in all age groups. The largest increase from 2006-2007 was in the 45-54 year old age group with a utilization increase of over 25%.

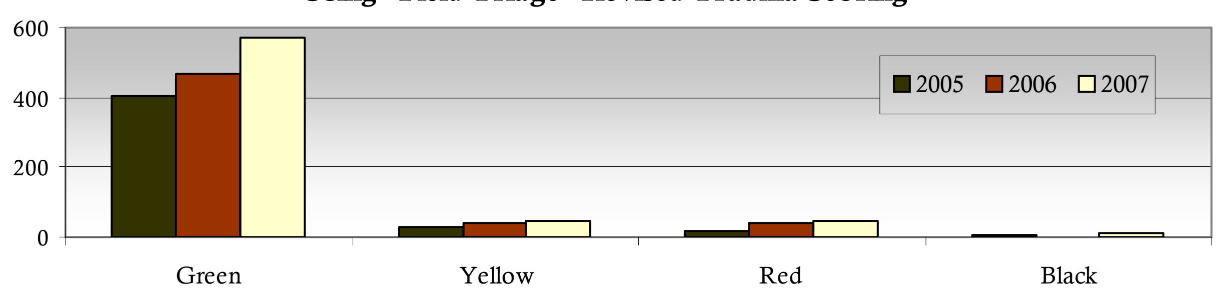
The Revised Trauma Score (RTS) is a physiological scoring tool used to predict mortality of injured patients. There are two RTS scales and both utilize Glasgow Coma Score (GCS), systolic blood pressure (SBP), and respiratory rate (RR). The most commonly used RTS tool is the weighted scale that gives emphasis to all three.

GCS	SBP	RR	Value
13-15	>89	10-29	4
9-12	76-89	>29	3
6-8	50-75	6-9	2
4-5	1-49	1-5	1
3	0	0	0

Revised Trauma Score for All Injured Patients Receiving an IO 2005-2006



Patients that Received an IO, Grouped by Severity Using "Field Triage" Revised Trauma Scoring



EMS Registry Project

In 2004, The Office of Emergency Medical Services (OEMS) signed a Memorandum of Understanding (MOU) with the National EMS Information System (NEMSIS). Since then, OEMS has been working on upgrading the pre-hospital patient care reporting program. The proposed system, which is called the EMS Registry to match its legal name, will be a statewide, web-based data collection and reporting tool. In addition, the EMS Registry project will provide EMS agencies with the ability to review their own data, thereby enabling quality monitoring and performance improvement to be conducted autonomously.

Benefits of becoming a NEMSIS state are numerous and include:

- A standardized data set nationwide that will allow comparison of Virginia data with other NEMSIS states
- A common computer language designed to share information between systems
- The ability to look at the complete EMS event

Why replace the current PPCR system?

1. Joint Legislative Audit and Review recommendation (Nov 2004)
2. Current system is technologically limited
3. Meet the business model of the NEMSIS project
4. Meet the Virginia Information Technology Agency's (VITA) vision for the Commonwealth
5. Meet the goals of the VDH strategic plan
6. Improve ease of compliance with VDH/OEMS *Code of Virginia* mandates
   § 32.1-113
   § 32.1-116.1

What should the EMS community expect?

- OEMS will seek the input of a sample of people in the EMS system to identify features to be included.
- OEMS will undergo the state procurement process of putting the EMS registry out for competitive bid through the request for proposals (RFP) process.
- Once the bid is made public, EMS stakeholders will be able to see the features and requirements to be included in a new program.
- When the award is made, the chosen vendor will develop both an implementation plan as well as a training plan.
- The data elements themselves and the technical format used to transfer the data to the State will change.
- EMS agencies will be required to maintain compliance with data submission. The laws, regulations, and policies relating to submitting PPCR data will not change; however, agencies will be provided a generous window of time to convert to the new program.

Virginia Information Technologies Agency VITA

NEMSIS TECHNICAL ASSISTANCE CENTER

VDH VIRGINIA DEPARTMENT OF HEALTH Protecting You and Your Environment

EMS Call Descriptions

The days of the week with the highest number of EMS calls are Fridays and Mondays. However the difference between the day with the highest call volume (Fridays) and the lowest call volume (Sundays) is less than two percent.

Overall, the vast majority of EMS calls had an incident disposition of treated and transported.

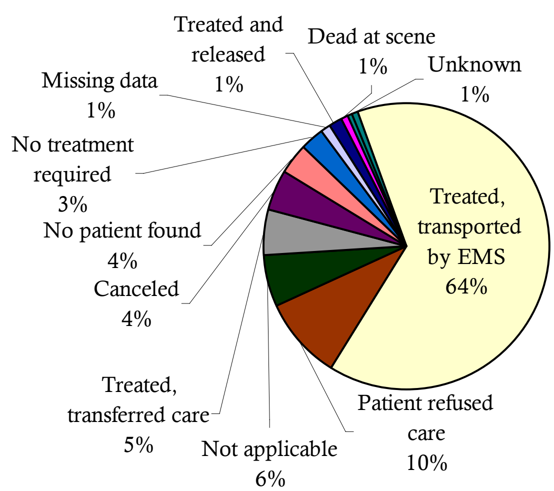
Total Call Distribution by Day of the Week

Day of the Week	Frequency
Sunday	119,280
Monday	129,736
Tuesday	124,345
Wednesday	124,965
Thursday	123,658
Friday	129,845
Saturday	123,035

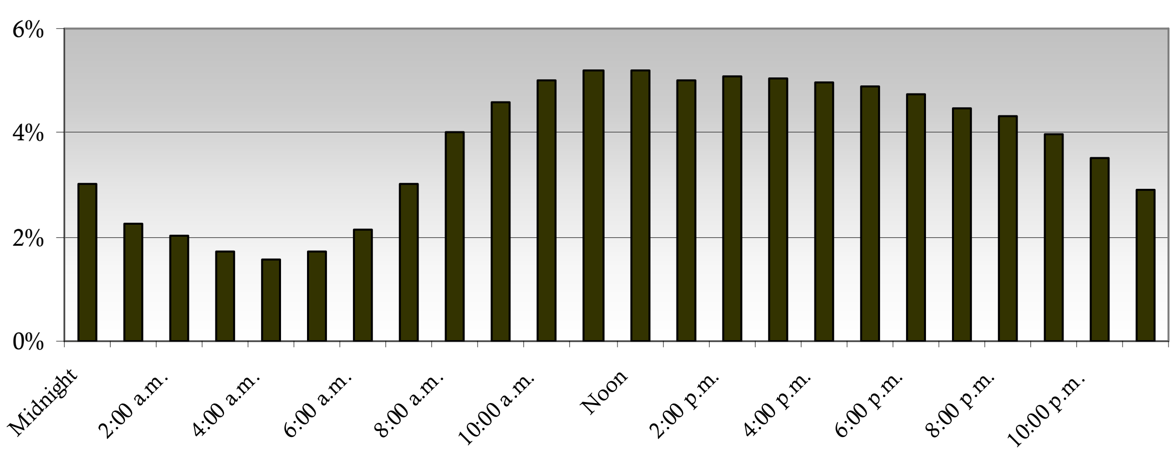
Incident Disposition

Disposition	Frequency
Treated, transported by EMS	526,264
Patient refused care	77,960
Not applicable	47,940
Treated, transferred care	43,286
Canceled	36,507
No patient found	28,757
No treatment required	21,983
Missing data	10,671
Treated and released	10,561
Dead at scene	7,325
Unknown	5,223
Treated, transported by private vehicle	3,528

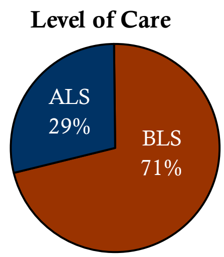
Incident Disposition



Hourly EMS Call Distribution



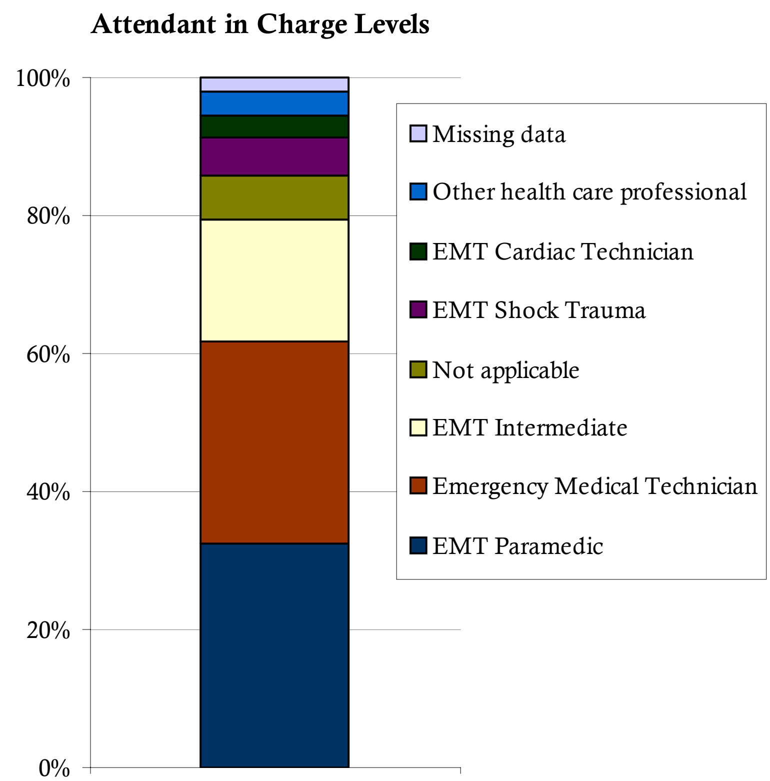
EMS Level of Care

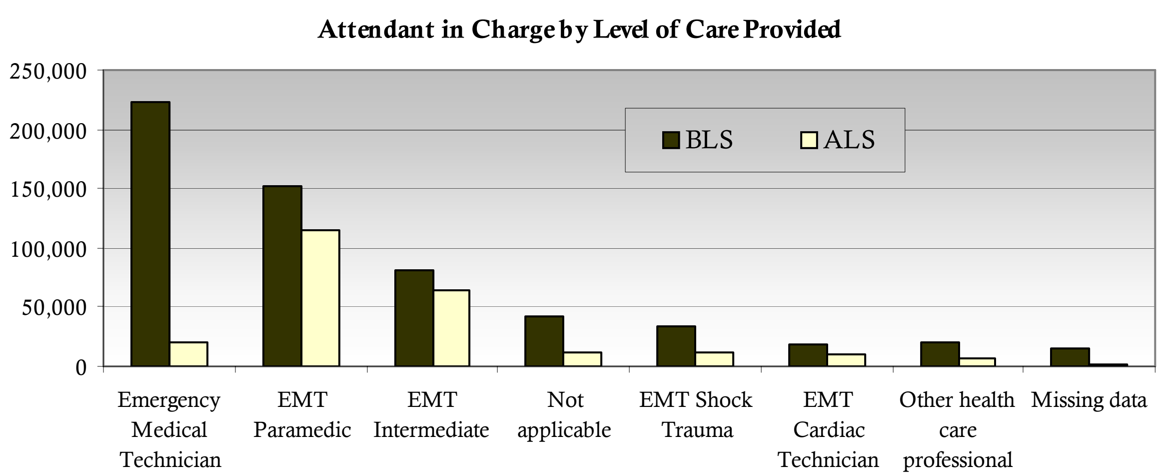


There were 835,233 calls submitted to OEMS for 2007, in which a level of care was documented. Of those, 590,693 were considered to be a basic life support (BLS) call and 244,540 were considered to be an advanced life support (ALS) call.

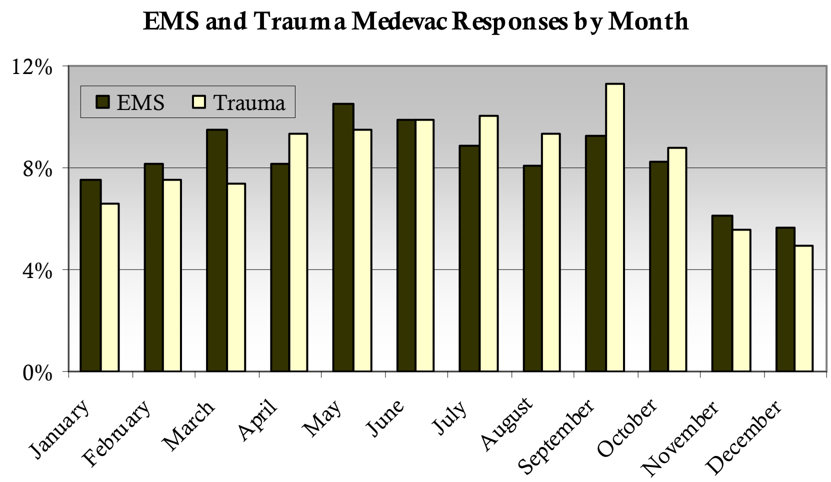
Over 60% of BLS calls had an attendant in charge (AIC) that was either an EMT Basic or Paramedic. The next largest provider group acting as AIC were EMT Intermediates. EMT-I's were the AIC on 14% of all BLS calls. Nearly 50% of ALS calls had an EMT-P as the AIC followed by EMT-I's comprising 26%.

Overall, 5% of calls had an EMT-Shock Trauma as AIC, 3% had an EMT-Cardiac Tech, and close to 1% had a registered nurse.



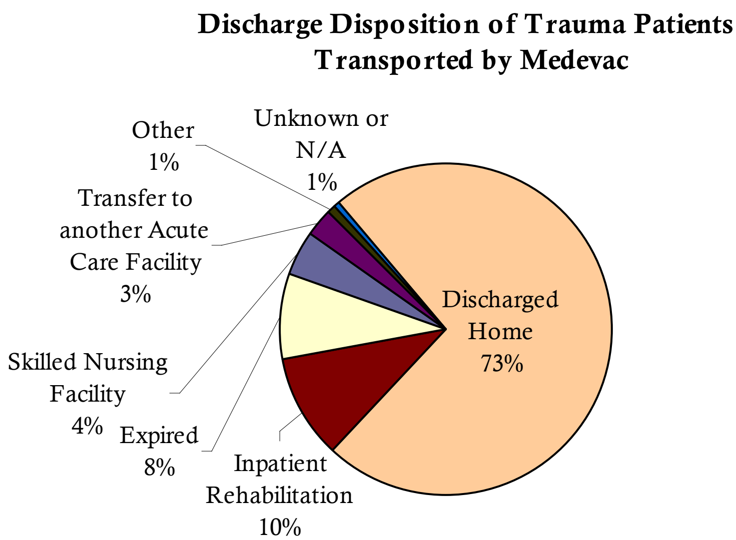


Medevac

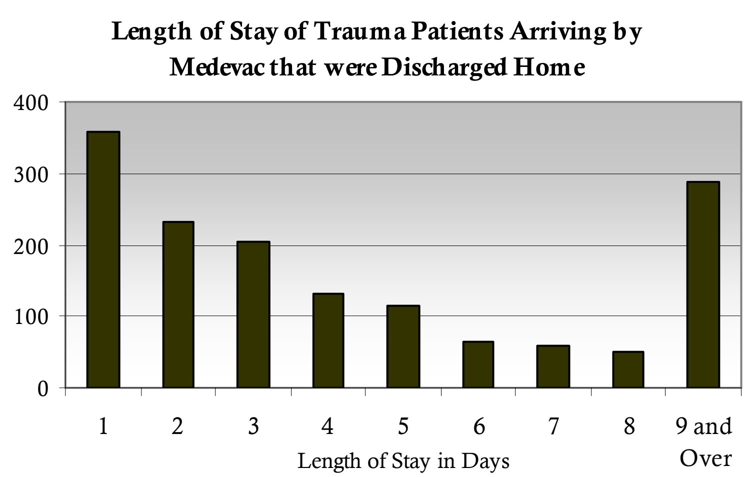


All agencies are required to submit EMS registry data, as specified in the *Code of Virginia.* The graph to the left shows the monthly distribution of calls reported to OEMS by the ten licensed Virginia air medical, Medevac, agencies. A total of 6,782 calls were reported by these agencies in 2007.

Hospitals are required to submit data on all trauma patients. A total of 2,058 trauma cases were reported by hospitals to have arrived by Medevac. It is important to note that these numbers are not limited to Medevac agencies licensed in Virginia but rather, includes all patients transported to a Virginia hospitals via Medevac.



- 73% of all trauma cases transported by Medevac were discharged home.
- 80% of trauma cases that were discharged home, had a length of stay of eight days or less.
- 24% of trauma cases that were discharged home had a length of stay less than or equal to one day.

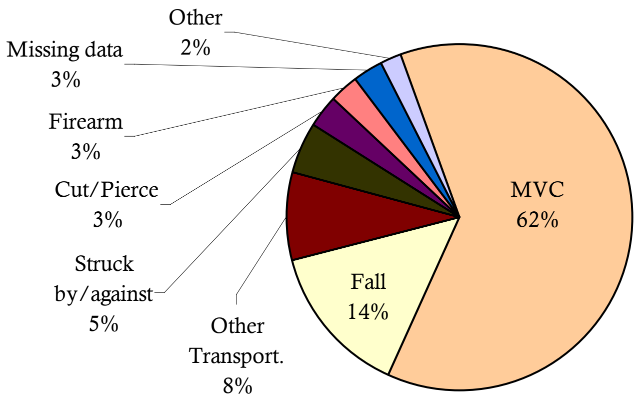


Medevac: One Day Admissions

A total of 2,058 trauma patients were transported by Medevac in 2007. Of those, 2,040 went to a designated trauma center and eight went to a non-designated hospital.

There were 358 trauma cases transported to a hospital by Medevac and discharged home within one day. 92% of those cases were flown to Level I Trauma Centers and 8% were Level II Centers. **All information contained on this page refers only to analysis conducted with those 358 cases.**

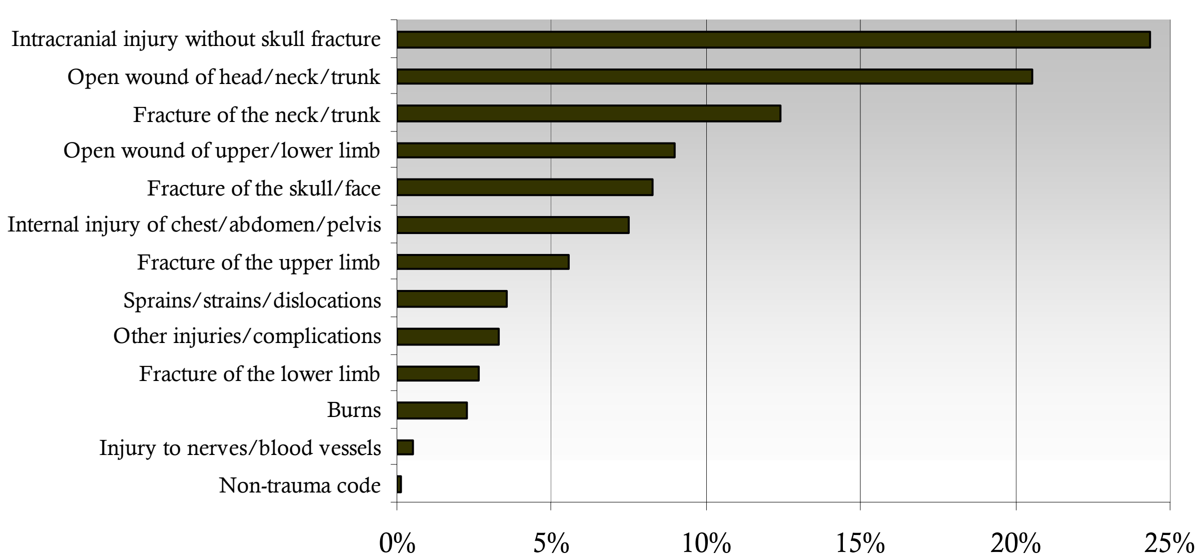
Injury Mechanisms of Medevac Patients Discharged Within One Day



Of the Medevac cases that were discharged home after a one-day hospital stay, over two hundred were involved in motor vehicle collisions (MVC). The second most common injury mechanism were falls, which at 50 patients, is a distant second.

Over half of the diagnoses of these patients can be grouped into three categories: Intracranial injuries, open wounds of the head/neck/trunk, and fractures of the neck/trunk.

Diagnoses of Medevac Patients Discharged Within One Day



Trauma Designation

All licensed hospitals are required by the *Code of Virginia* to submit data on their trauma cases to the Virginia Statewide Trauma Registry. Of those 94 licensed hospitals, 14 have been designated as a trauma center. A trauma center's designation is defined by the following criteria:

Level I
Level I trauma centers have an organized trauma response and are required to provide total care for every aspect of injury, from prevention through rehabilitation. These facilities must have adequate depth of resources and personnel with the capability of providing leadership, education, research, and system planning.

Level II
Level II trauma centers have an organized trauma response and are also expected to provide initial definitive care, regardless of the severity of injury. The specialty requirements may be fulfilled by on call staff, that are promptly available to the patient. Due to limited resources, Level II centers may have to transfer more complex injuries to a Level I center. Level II centers should also take on responsibility for education and system leadership within their region.

Level III
Level III trauma centers, through an organized trauma response, can provide prompt assessment, resuscitation, stabilization, emergency operations and also arrange for the transfer of the patient to a facility that can provide definitive trauma care. Level III centers should also take on responsibility for education and system leadership within their region.

Level I Trauma Centers

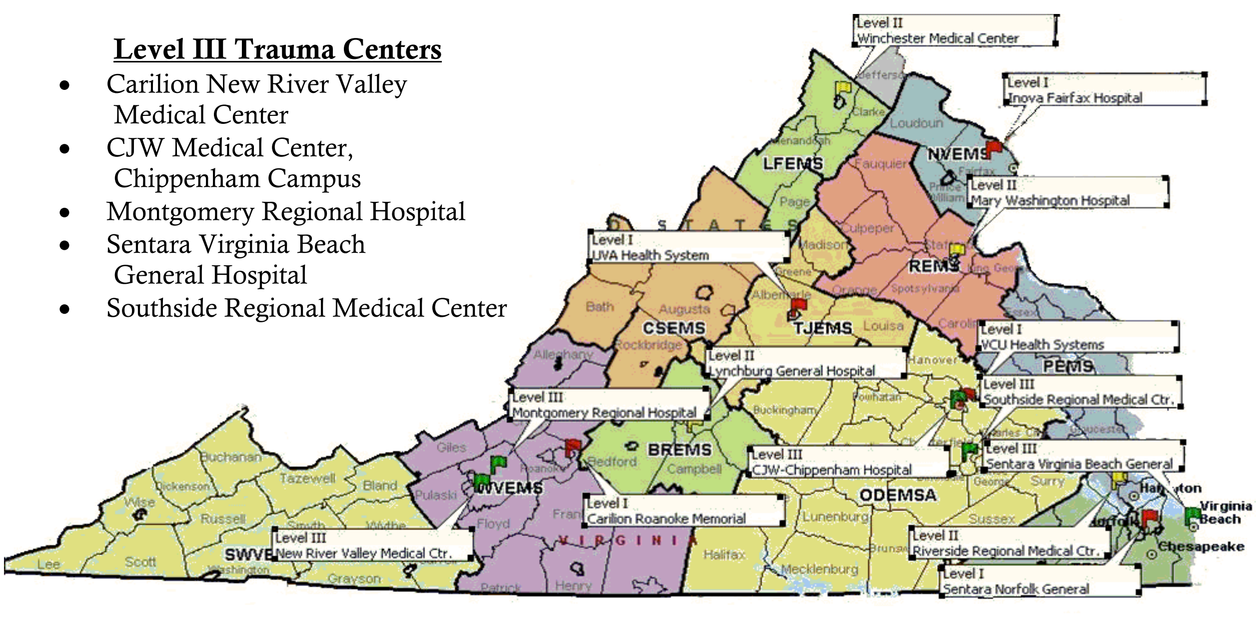
- Carillion Roanoke Memorial Hospital
- Inova Fairfax Hospital
- Sentara Norfolk General Hospital
- UVA Health System
- VCU Health Systems

Level II Trauma Centers

- Lynchburg General Hospital
- Riverside Regional Medical Center
- Winchester Medical Center
- Mary Washington Hospital *(Designated in 9/2008. Not included as a designated Trauma Center in data analyses on the following pages).*

Level III Trauma Centers

- Carilion New River Valley Medical Center
- CJW Medical Center, Chippenham Campus
- Montgomery Regional Hospital
- Sentara Virginia Beach General Hospital
- Southside Regional Medical Center



Trauma Designation

Required Surgical Clinical Capabilities:
(On call and promptly available)

Surgical Clinical Capabilities	**Level of Designation** I	II	III
Cardiac Surgery	X		
Thoracic Surgery	X	X	
Orthopedic Surgery	X	X	X
Pediatric Surgery	X		
Hand Surgery	X		
Microvascular/Replant	X		
Plastic Surgery	X	X	
Maxillofacial Surgery	X	X	
Ear, Nose & Throat Surgery	X	X	
Oral Surgery	X		
Ophthalmic Surgery	X	X	
Gynecological Surgery/ Obstetrical Surgery	X	X	

All levels of trauma center designation are required to have an organized approach to trauma care; this includes an appropriately staffed "trauma team" that respond to pre-established criteria (trauma alert). All levels are also required to have a trauma (general) surgeon as the team leader of a trauma team alert, have an anesthesiologist and operating room immediately available, and for Level I and II centers a neurosurgeon promptly available as well.

In addition to these requirements, the tables demonstrate the minimum surgical and medical physician capabilities each level of trauma center are required to have promptly available to trauma patients.

Each trauma center undergoes close scrutiny by a site review team every three years; sooner for newer centers. The team consist of a Surgeon/Team Leader, Emergency Physician, Critical Care Nurse, Hospital Administrator, and the OEMS Trauma Coordinator.

The team evaluates such aspects as the trauma response throughout the hospital, patient care provided, compliance with educational criteria, and performance improvement. Designated Trauma Centers are also required to have an outreach program in place to communicate with hospital and EMS agencies located within its catchment area. This serves to complete the informational feedback loop.

Required Medical Clinical Capabilities:
(On call and promptly available)

Medical Clinical Capabilities	**Level of Designation** I	II	III
Cardiology	X	X	
Pulmonology	X		
Gastroenterology	X		
Hematology	X		
Infectious Disease	X		
Internal Medicine	X	X	X
Nephrology	X		
Pathology	X	X	X
Pediatrics	X		
Radiology	X	X	X
Interventional Radiology	X		

Trauma Fund

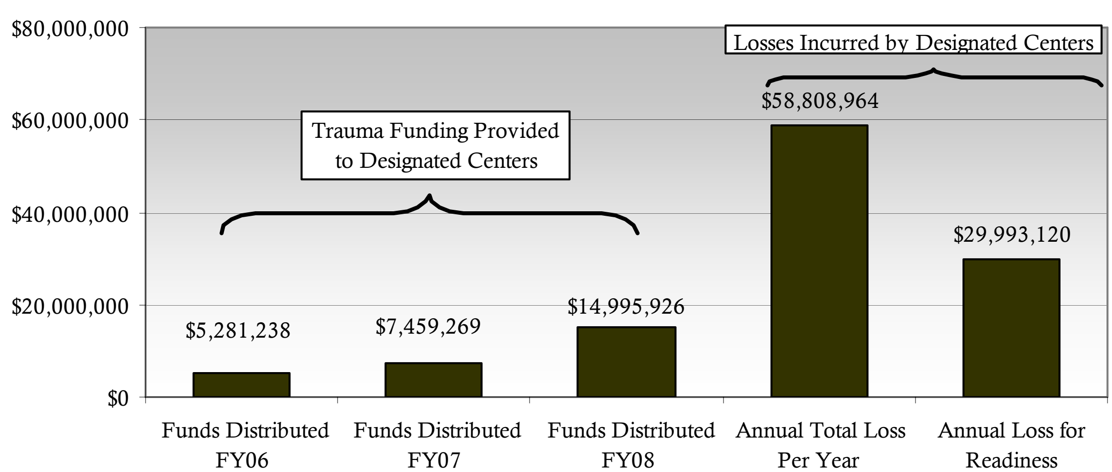
In Virginia, 14 hospitals voluntarily undergo trauma center designation and commit to provide a higher level of care necessary to the seriously injured. Despite the value trauma centers provide to the community, trauma centers face a variety of financial challenges. A 2004 Joint Legislative and Audit Commission (JLARC) study demonstrated that a combined $44 million was being lost each year by the Virginia hospitals that are designated as trauma centers. The table below demonstrates the different categories of these losses and the estimated increases that have occurred since the JLARC study.

Losses Incurred by Designated Trauma Centers

Source of Losses	2003	2004	2005	2006	2007	2008
Unreimbursed Readiness Cost of Publicly Insured Patients	$5,000,000	$5,135,000	$5,309,590	$5,479,497	$5,632,923	$5,773,746
Unreimbursed Readiness Cost of Privately Insured Patients	$12,000,000	$15,240,000	$15,758,160	$16,262,421	$16,717,769	$17,135,713
Unreimbursed Readiness Cost of Uninsured Patients	$6,400,000	$8,128,000	$8,404,352	$8,673,291	$8,916,143	$9,139,047
Losses on Clinical Care Provided to Publicly Insured Patients	$7,000,000	$8,890,000	$9,192,260	$9,486,412	$9,752,032	$9,995,833
Losses on Clinical Care Provided to Uninsured Patients	$13,600,000	$17,272,000	$17,859,248	$18,430,744	$18,946,805	$19,420,475
	$44,000,000	$45,188,000	$46,724,392	$48,219,573	$49,569,721	$50,808,964

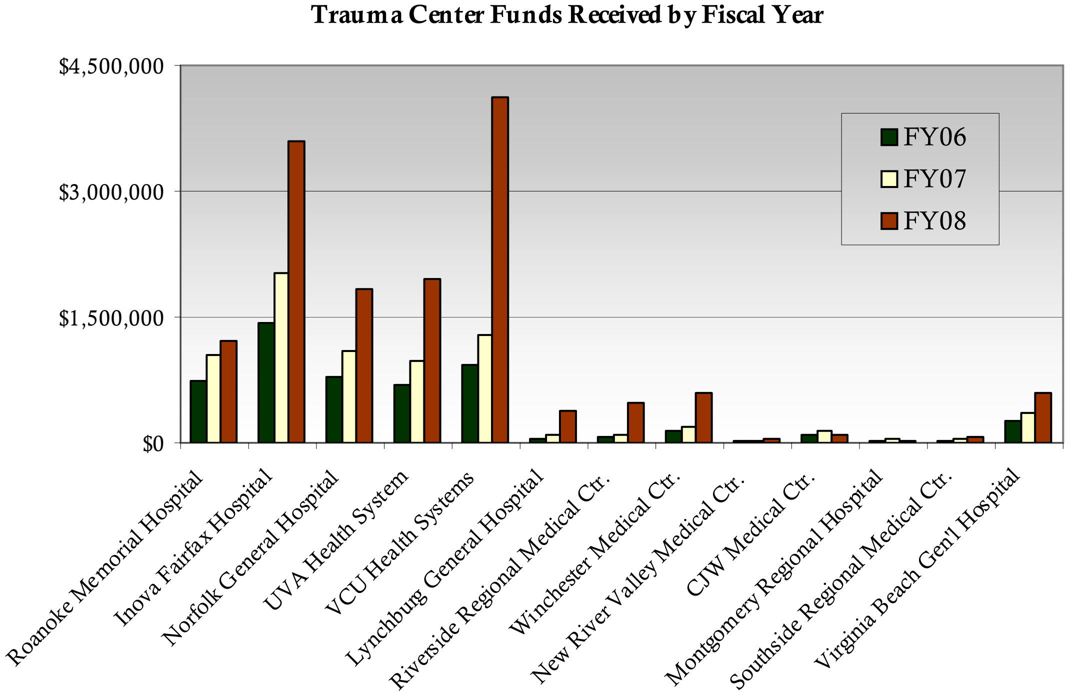
These challenges are deterring additional hospitals from seeking trauma center designation. In the 2004 General Assembly Session House Bill (HB) 1143 amended the *Code of Virginia* by adding section 18.2-270.01 which established the Trauma Center Fund for the Commonwealth of Virginia.

Trauma Funds Distributed vs. Baseline Loss Per Year

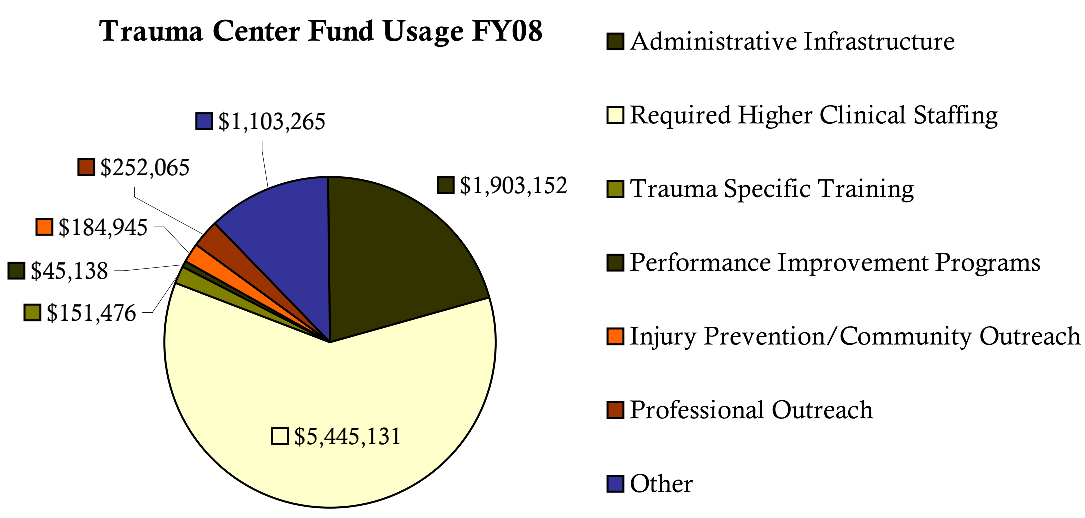


Trauma Fund

The Trauma Center Fund first began distributing funds in late 2005 and has provided almost $25 million to Virginia's Designated Trauma Centers.



Each trauma center is required to report annually to OEMS demonstrating how they utilized its proceeds from the Trauma Fund. A break down on how funds were used during FY08 is below. More information on the Trauma Center Fund can be found on OEMS' Trauma/ Critical Care Web page.

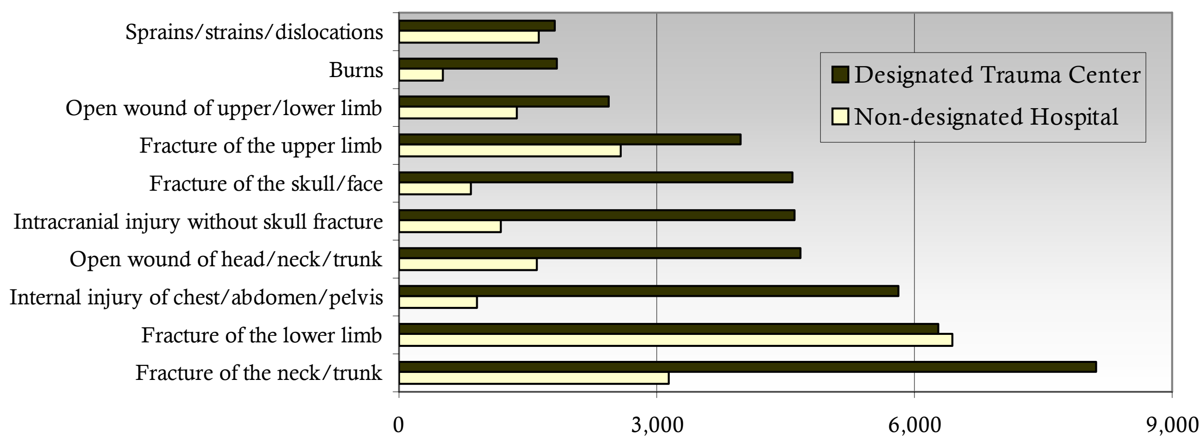


Trauma Admissions

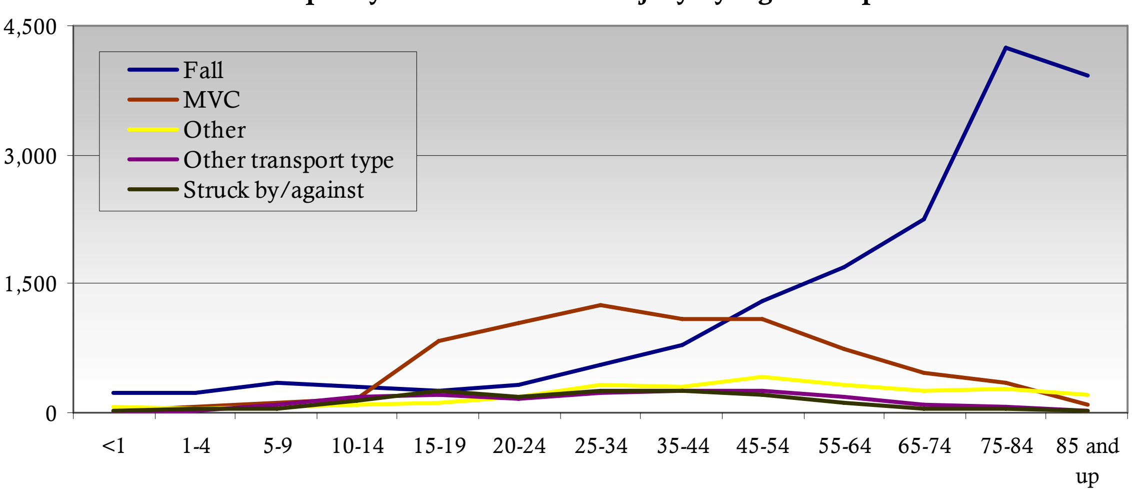
Demographics of trauma patients: 68% of patients treated at designated trauma centers and 78% of patients treated at non-designated hospitals self-identified their race as white. According to the 2006 US census projections, 19% of people in Virginia self identified themselves as black, however, only 13% of patients treated at non-designated hospitals were black and almost 20% of patients seen at designated trauma centers were black. A possible reason for discrepancy is that designated trauma centers are primarily located in urban areas that have higher rates of minority citizens. Gender distribution was fairly equal with 53% of all trauma patients being male.

The most common diagnoses for both designated and non-designated trauma centers were fractures. For designated trauma centers, the most common type of fracture was a neck or trunk fracture. For non-designated hospitals, the most common fracture was of the lower limb, of which the majority of cases were isolated hip fractures. These diagnoses are consistent with the most common injury mechanisms demonstrated by age, in the graph at the bottom of the page.

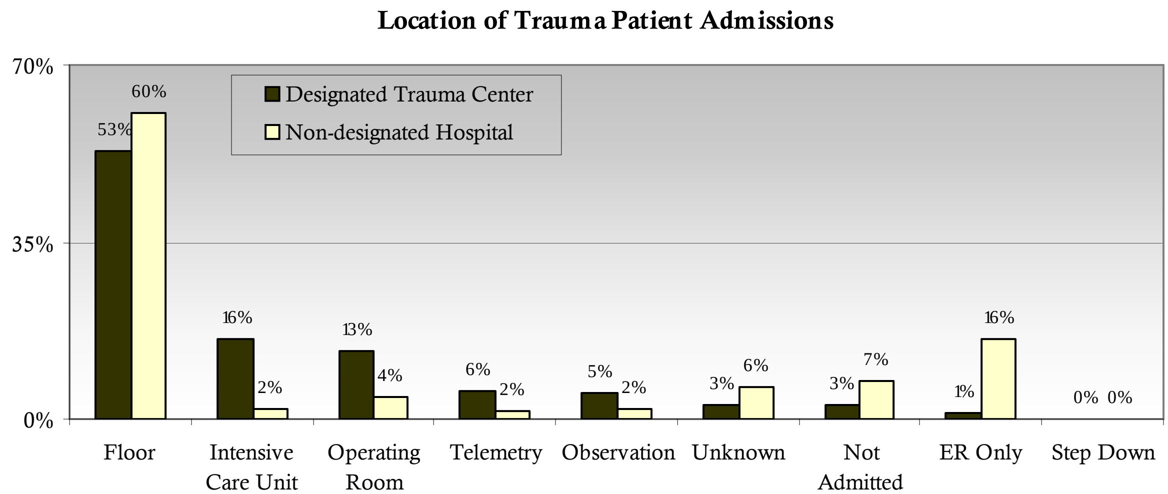
Most Common Diagnoses



Frequency of Mechanism of Injury by Age Group



Admission Location



Operating Room Admissions in Non-designated Hospitals

As part of an assessment of Virginia's statewide trauma triage plan, the Trauma/Critical Care Division used the Virginia Statewide Trauma Registry (VSTR) to look at a number of scenarios. One scenario was a focus on trauma patients admitted directly to the operating room (OR) of a non-designated hospital. If identified in excess, this issue may be an indicator of under-triage if it is coupled with long lengths of stay and untoward outcomes.

In determining this total, **patients over 65 years that suffered from an isolated hip fracture were excluded**. This left 558 trauma patients that were admitted directly to the operating room of a non-designated hospital. The length of stay of those patients ranged from 1 to 45 days with a mean length of stay of just over 2.5 days and a median length of stay of one day. The ages ranged from newborn through 99 years old. The average age was 48 and the median age was 50.

Outcomes of Patients Admitted Directly to the Operating Room

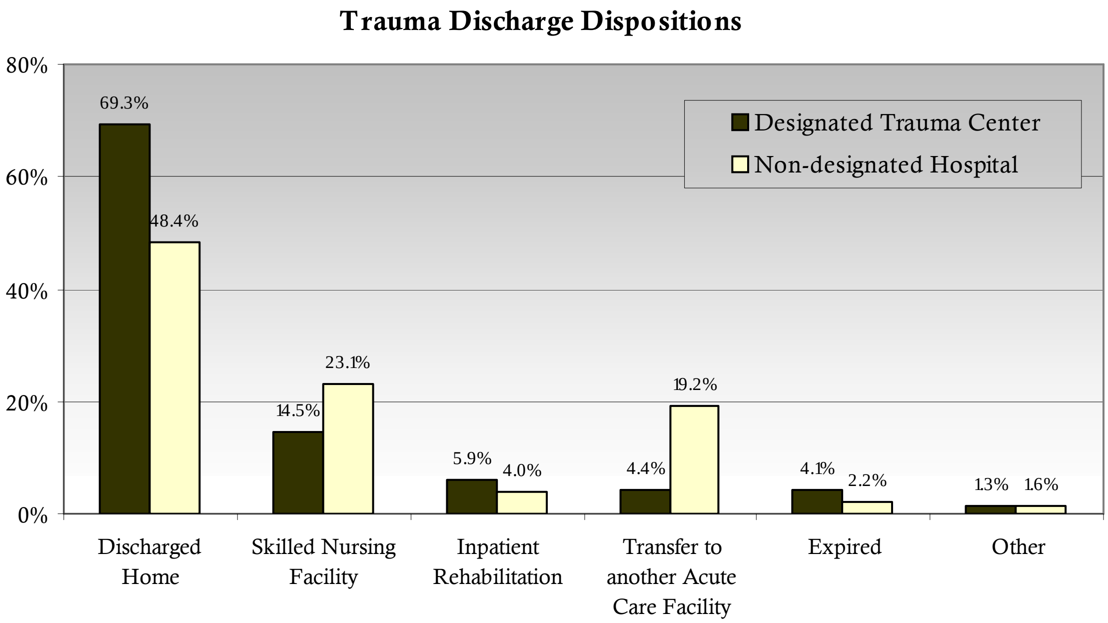
Outcome	Frequency
Discharged Home	447
Expired	44
Inpatient Rehabilitation	40
Skilled Nursing Facility	11
Transfer to another Acute Care Facility	7
Other	5
Unknown or N/A	4

Overall these patients had favorable outcomes with 80% being discharged home and only 8% with an outcome of expired.

Information on direct admissions to the operating room excluded Children's Hospital of the King's Daughter. While not a designated trauma center, CHKD is a specialty resource center that provides definitive care to the pediatric population. It is expected that a large portion of their trauma population may be admitted directly to the operating room and because of that, these cases were excluded to avoid inflating the totals. Pediatric trauma information can be found in the EMS for Children section of this report.

Trauma Outcomes

With proper triage, the most severe traumas will be transported to designated trauma centers. That being the case, an inevitable consequence of such a process will be higher fatality rates at those hospitals. This higher rate is in no way indicative of their care and should not be cause for alarm, it is a common statistical paradox.



Literature Brief

Reduced mortality at a community hospital trauma center: the impact of changing trauma level designation from II to I

***Archives of Surgery,* January 2008**

Summary:
The purpose of this study was to determine if a change in trauma designation from Level II to Level I in the same institution reduces mortality by using a retrospective cohort study of all patients consecutively admitted to a community hospital trauma center.

After adjusting for many potentially confounding variables, results found a significant decrease in overall mortality during Level I designation compared with Level II designation. This reduction applied to all three groups measured:

- Overall severely injured patients (ISS greater than or equal to 15)
- Patients with severe head, chest, abdominal or pelvic injury diagnosis
- Patients who developed complications during their hospital stay

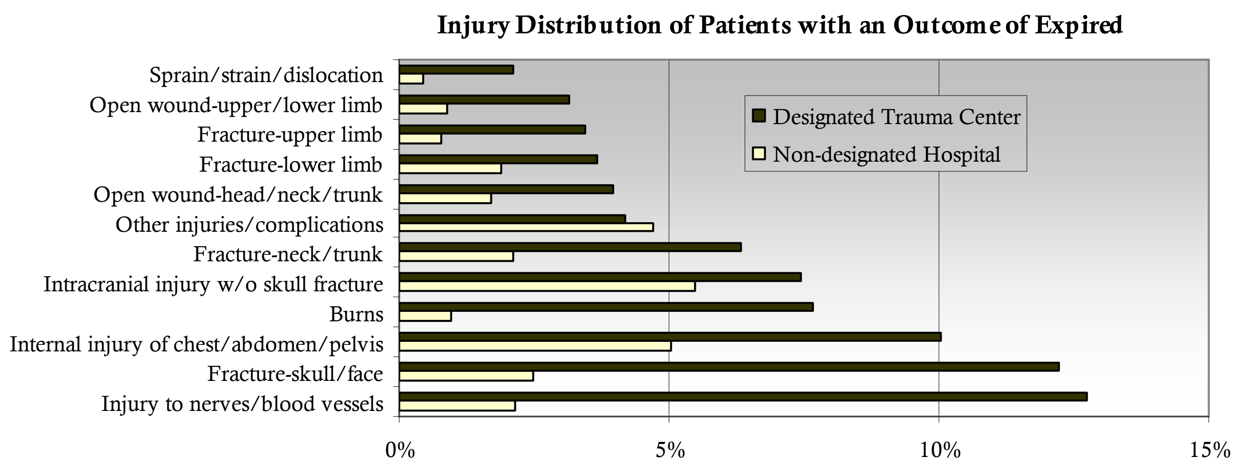
The significant reduction in mortality of trauma patients with severe or specific injuries after the change to a higher trauma level designation may justify direct triage of these patients to Level I facilities, when available.

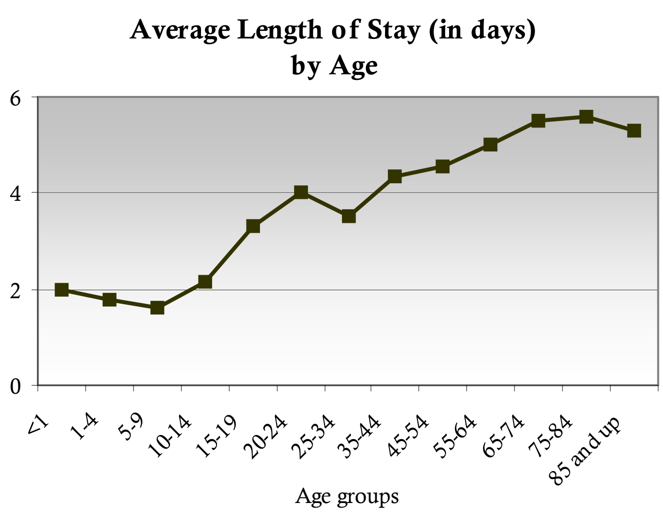
Trauma Outcomes

Length of stay varies by age with an increase in age being associated with an increase in the length of stay. Children ages 5 to 9 have the shortest length of stay of 1.6 days. The longest length of stay are those patients 75 to 84 with an average just over 5.5 days. The majority of those elderly patients suffered a fracture due to a fall and may have had additional co-morbid factors due to their age.

Hospitals may submit up to nine diagnosis codes for each patient. The chart below shows the injuries of those patients who died at the hospital. Note, these are co-morbid diagnoses with most patients having at least two diagnoses in each of these groups.

Average length of stay (bottom of page) was calculated for all patients combined.





Length of Stay by Age

Age (years)	Average Length of Stay (in days)	Frequency
<1	2.00	238
1-4	1.80	657
5-9	1.61	713
10-14	2.17	963
15-19	3.32	1,968
20-24	4.00	2,298
25-34	3.53	3,165
35-44	4.33	3,113
45-54	4.55	3,621
55-64	5.00	3,245
65-74	5.49	3,213
75-84	5.57	5,076
85 and up	5.30	4,326

National Trauma Trends

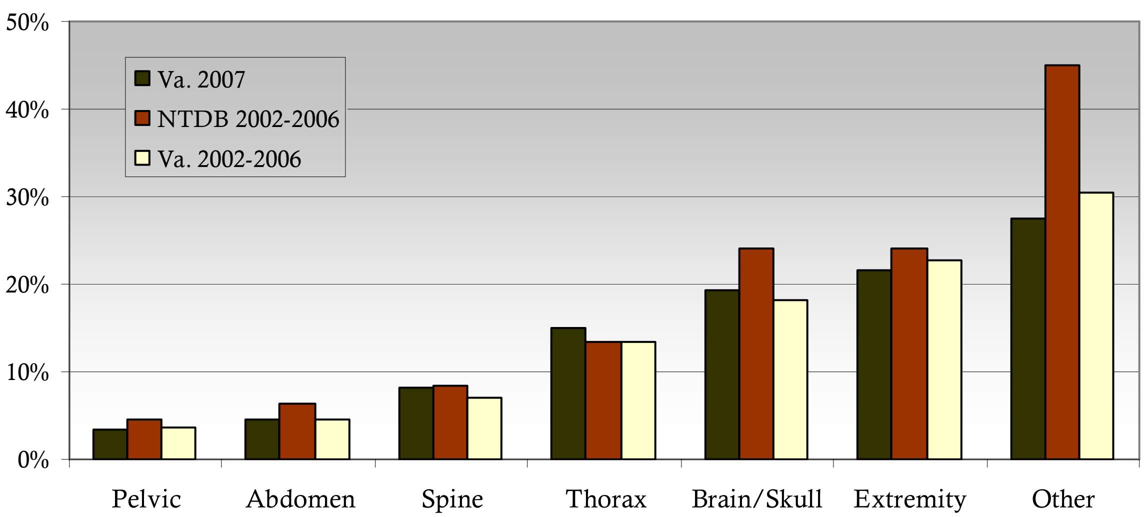
The National Trauma Data Bank (NTDB) collects data from trauma centers throughout the country as a form of passive surveillance. The NTDB identifies its goals as "to inform the medical community, the public, and decision makers about a wide variety of issues that characterize the current state of care for injured persons in our country".

Data on the following three pages is from the NTDB 2007 Annual Report. This report included aggregate data from 2002-2006, from 712 trauma centers across the United States. More information on the NTDB can be found at: *http://www.facs.org/trauma/ntdb.html*

Two distinct sets of Virginia data were used in the comparisons to the national data. The range of 2002-2006 was used in order to directly compare the Virginia trends to national. Data from 2007 was also included, as it represents the most current and complete full year snapshot. Both Virginia sets include only data from the 13 designated trauma centers.

The graph below shows the distribution of injuries according to organ system. Most incidents involve multiple organ systems and a patient will then be counted in each of the affected organ systems. The percentages are calculated by dividing the number of incidents in each organ system by the total number of incidents.

Frequency of Organ System Trauma



National Fact:
Case fatality rates are highest for those patients with abdominal and/or thoracic injuries. For patients with head injuries, the case fatality rate was highest for those with both brain and skull injuries. For those with thoracic injuries, case fatality rate was highest for patients with heart or tracheobronchial tree/esophagus injuries. Patients with liver, GI tract, or other/unknown abdominal injuries had the highest case fatality rate among those with an abdominal injury.
Source—*National Trauma Data Bank Annual Report 2007*

National Trauma Trends

Case fatality rate is defined as the proportion of individuals contracting a disease who die as a result of that disease (*American Heritage Medical Dictionary*, 2007). For the purposes of this document it can be considered the proportion (percentage) of injured people that die as a result of those injuries. Virginia data from both 2002-2006 as well as 2007, closely mirrors the national trends.

Literature Brief

Do designated trauma systems improve outcome?

Current Opinion in Critical Care, December 2007

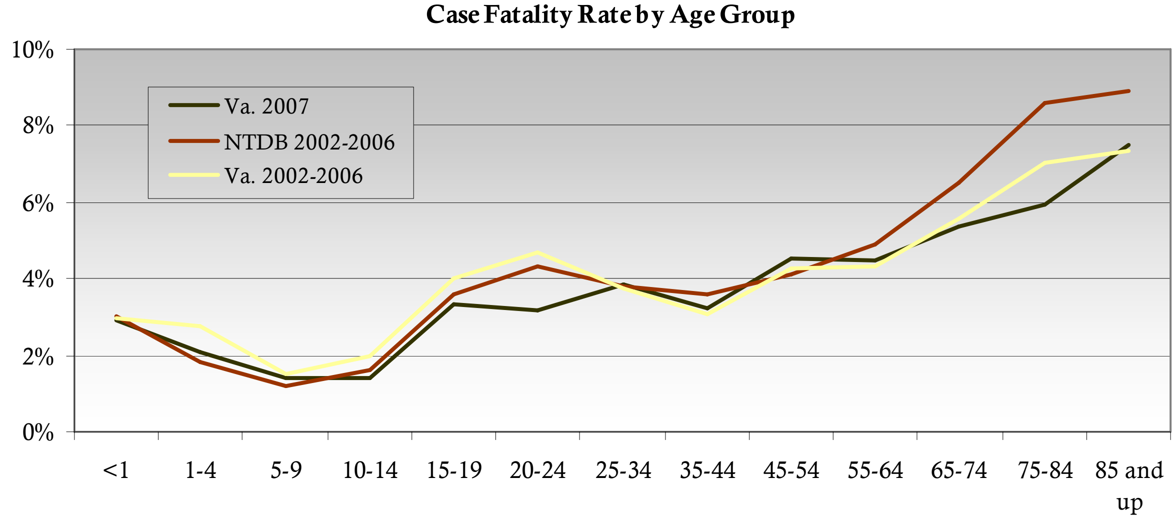
Summary:
Trauma systems are introduced world wide with the goal to improve survival and outcome of the injured patient. This review is focused on the influence of trauma systems on the survival and outcome of injured patients.

Large population-based studies have been published over the last two years strengthening the hypothesis that trauma systems indeed improve survival rates in injured patients. Although 'inclusive' trauma systems have been advocated since 1991, only recently were they proven to perform better than exclusive systems. Because further improvements in survival in mature trauma systems are likely to be small, more focus should be given to quality of life studies, rather than survival, in trauma system evaluation.

2007 Virginia Case Fatality Rates

Age Group	Frequency	Deaths	Case Fatality Rate
<1	138	4	2.9%
1-4	337	7	2.1%
5-9	360	5	1.4%
10-14	507	7	1.4%
15-19	1,404	47	3.3%
20-24	1,744	55	3.2%
25-34	2,155	83	3.9%
35-44	2,048	66	3.2%
45-54	2,161	98	4.5%
55-64	1,634	73	4.5%
65-74	1,360	73	5.4%
75-84	1,867	111	5.9%
85 and up	1,402	105	7.5%
Total	17,117	734	

Case Fatality Rate by Age Group



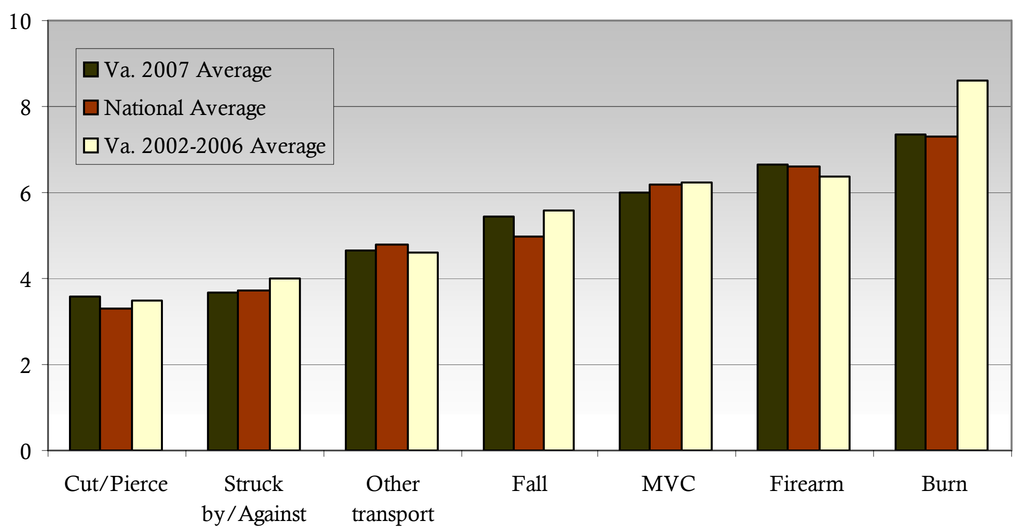
National Trauma Trends

Virginia data closely mirrors national data in regards to length of stay by injury mechanism. The difference in length of stay for falls between Virginia and the national average may be attributed to Virginia's trauma registry inclusion criteria. Virginia collects isolated hip fractures of the elderly, while many states exclude that from their trauma registries. This difference may cause the length of stay for "falls" in Virginia to appear significantly higher than national data.

Average Length of Stay (LOS) by Injury Mechanism

Mechanism	Total Cases (Virginia)	LOS (in days) Virginia 2007	LOS (in days) NTDB 2002-2006	LOS (in days) Virginia 2002-2006
Fall	6,487	5.4	5.0	5.6
MVC	5,825	6.0	6.2	6.2
Other transport type	1,132	4.8	4.8	4.6
Struck by/Against	939	3.7	3.7	4.0
Firearm	741	6.7	6.6	6.4
Cut/Pierce	646	3.6	3.3	3.5
Burn	445	7.3	7.3	8.6

Average Length of Stay (in days) by Injury Mechanism

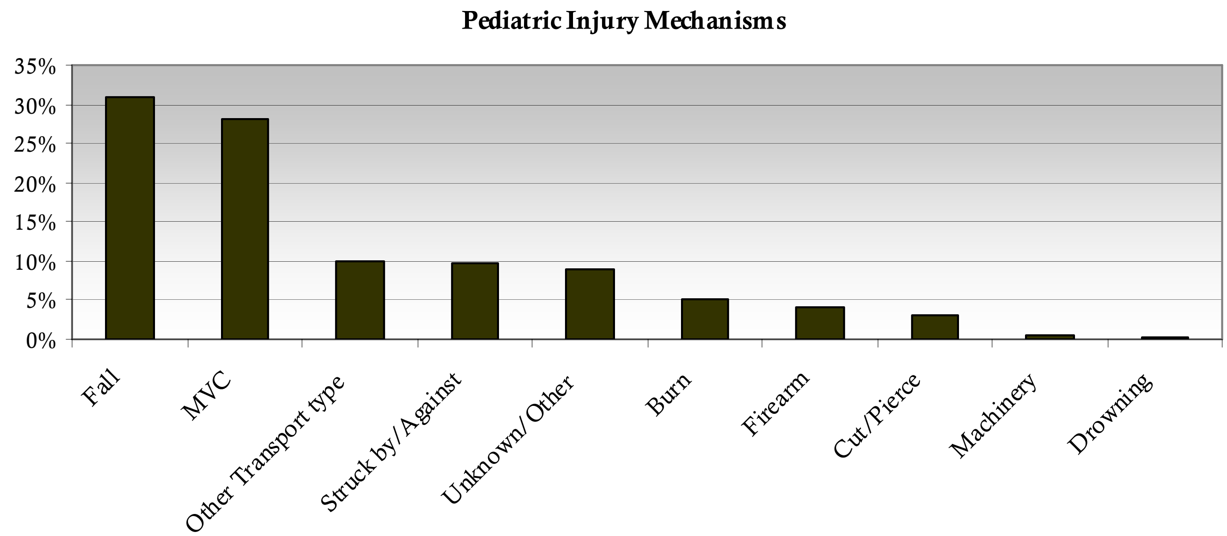


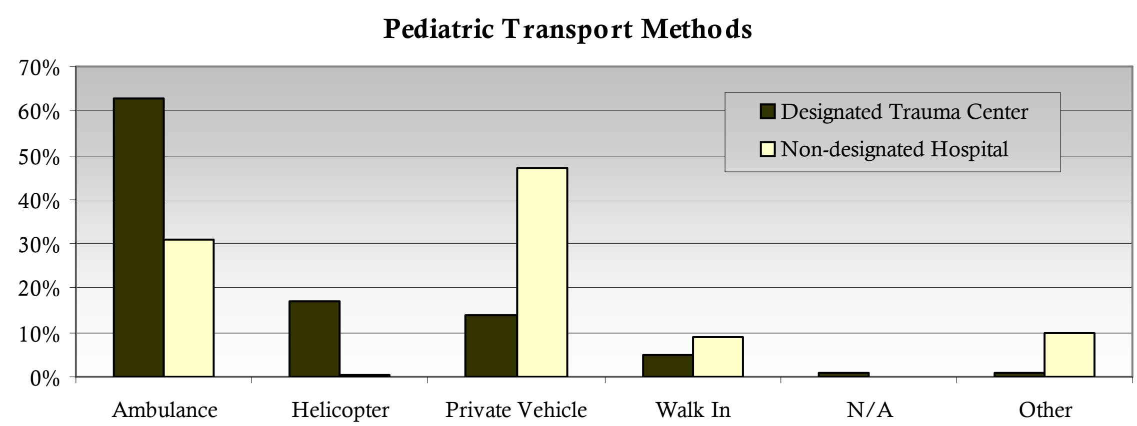
National Fact:
Motor vehicle traffic related injures account for 37.9% of cases in the NTDB, with a dramatic rise between age 14 and 24, peaking around age 19.
Source—*National Trauma Data Bank Annual Report 2007*

Pediatric Trauma Care

In 2007 there were 4,268 pediatric (under 19 years old) trauma cases. This comprised almost 14% of all cases at designated trauma centers and just over 11% at non-designated hospitals.

Overall, 49% of all pediatric trauma patients were transported to the hospital by an ambulance. When broken down by designated and non-designated trauma center, 63% of pediatric cases going to a designated trauma center arrived by ambulance versus 31% going to non-designated hospitals. The main method of transport to non-designated hospitals is by private vehicle. Medevac units were the second most common method of transport to designated trauma centers, transporting almost 17% of cases.





National Fact:
Children ages 15 to 19 comprise only 10% of the population reported in the NTDB, yet make up 19% of all traumas associated with a firearm.
Source—*National Trauma Data Bank Annual Report 2007*

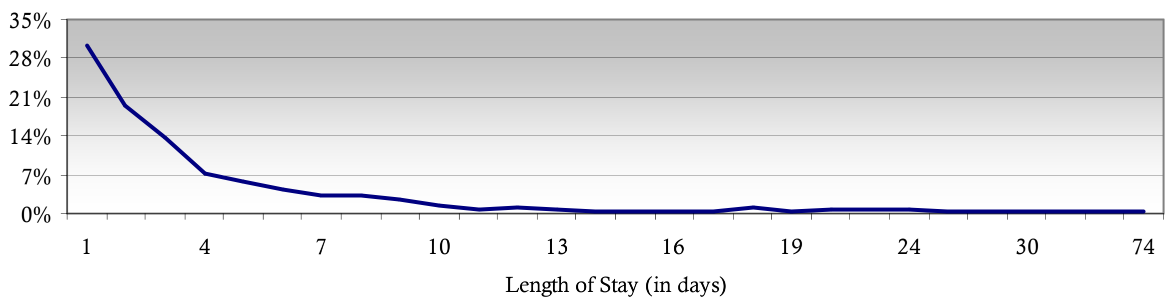
Pediatric Trauma Care

EMS for Children (EMSC)
Emergency care providers face special challenges when confronted with ill and injured children. Children have unique physical presentations, differing body responses to illness and injury, and a need for appropriately-sized medical equipment and drug preparations. Virginia's EMSC program is working to improve pediatric emergency care capabilities within the Commonwealth at every level of the patient care spectrum, from prevention to pre-hospital care, to hospital acute care, and rehabilitation services.

The EMSC program is housed within the OEMS' Division of Trauma and Critical Care and is currently assisting facilities and agencies in assessing their current ability to care for children. As opportunities for improvement are identified, the EMSC program is fostering system development initiatives to facilitate movement toward that improvement.

In 2009 special emphasis is being placed on assisting hospitals develop written pediatric inter-facility transfer guidelines and agreements. These tools aid in rapidly moving critical pediatric cases to the hospitals that can most appropriately manage their emergency care. By integrating pediatric care concerns into every level of the patient care spectrum, Virginia is committed to providing the best care possible for children and adolescents.

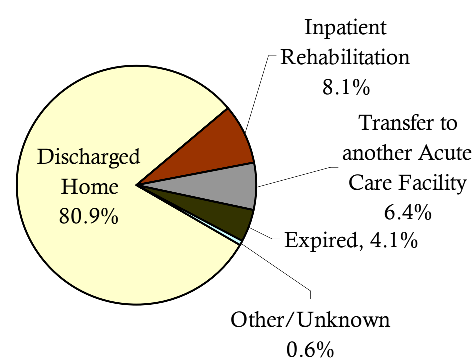
Length of Stay of Pediatric Trauma Patients Arriving by Helicopter that were Discharged Home



The overwhelming majority of pediatric trauma patients that were transported by Medevac were discharged home. Six percent of patients were transferred to another acute care facility. Seventy-six percent of those inter-facility transfers were cases that were transported by Medevac to Carillion Roanoke Memorial Hospital (CRMH) and then, following proper triage guidelines, were transported the short distance by ground to Carillion Roanoke Community Hospital (CRCH). At the time, CRCH handled all pediatric trauma cases for the Carillion Roanoke Hospitals, but has since closed (September 2007).

The average length of stay for all pediatric trauma patients was just under three days (2.7). The median and most common length of stay was one day. The average length of stay for a pediatric patient arriving by Medevac was 4.8 days with a median of three days and the most common length of stay being one day.

Outcomes of Pediatric Trauma Cases Arriving by Helicopter

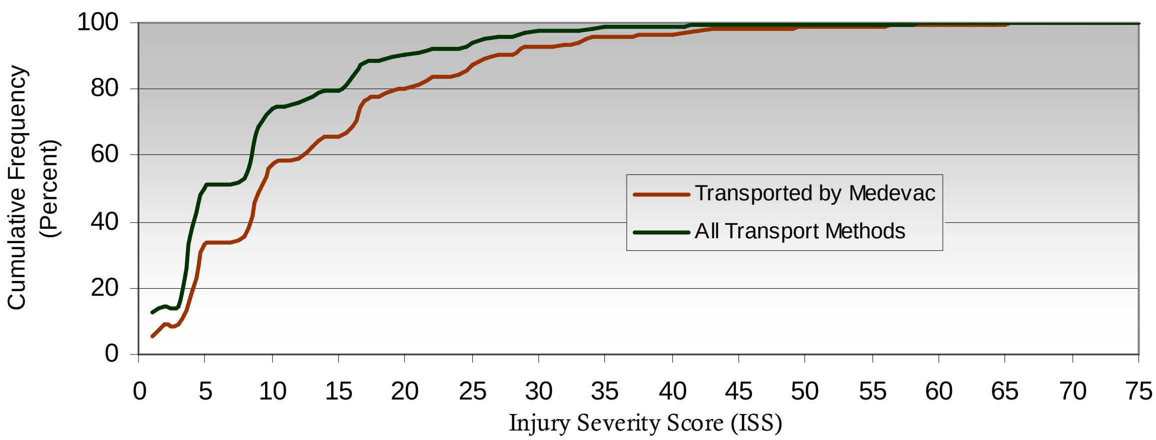


Pediatric Trauma Care

Injury severity score (ISS) is a system of numerically stratifying injury severity. ISS has a range from 1-75 and risk of death increases with a higher score (NTDB 2007). Overall in Virginia, pediatric trauma patients had an average ISS of 9, median of 5, and the most common ISS was 4. For pediatric patients that were transported to the hospital by a Medevac unit, the average ISS was 13, the median 13, and the most frequent was 5.

Below is a graph showing cumulative frequency of the pediatric injury severity score. This can be found on a frequency distribution table by adding each frequency to the sum of its predecessor. An example of how it can be interpreted is "Approximately 75% of cases transported (any method) had an ISS of 10 or less and approximately 58% of cases transported by Medevac had an ISS of ten or less".

Cumulative Distribution of Pediatric Injury Severity Scores



Literature Brief

Pediatric inter-hospital transport: Diagnostic discordance and hospital mortality

Pediatric Critical Care Medicine, January 2008

Summary:
A cross-sectional analysis of prospectively collected transport data was used to determine the rate of discordance between the reason for transport (determined by referring institution) and the final diagnosis (determined by accepting institution). Inter-facility transport of neonatal and pediatric patients referred to five tertiary centers was included.

Discordant events were categorized by diagnosis, referring hospital location, and physician type. Discordance between primary reason for transport and discharge diagnosis category occurred in 474 (11.5%) transport events. Significant predictors of diagnostic discordance included diagnoses of gastrointestinal, metabolic, multi-trauma with head injury, multi-trauma without head injury, renal, and toxicology. Acute care, referring physician, and emergency department subpopulations demonstrated similar discordance rates.

Discordance between primary reason for transport and diagnosis category is common in the pediatric inter-hospital transport population. Although discordance does not appear to lead to increased mortality, further study is needed to determine the impact of diagnostic discordance on other patient outcomes.

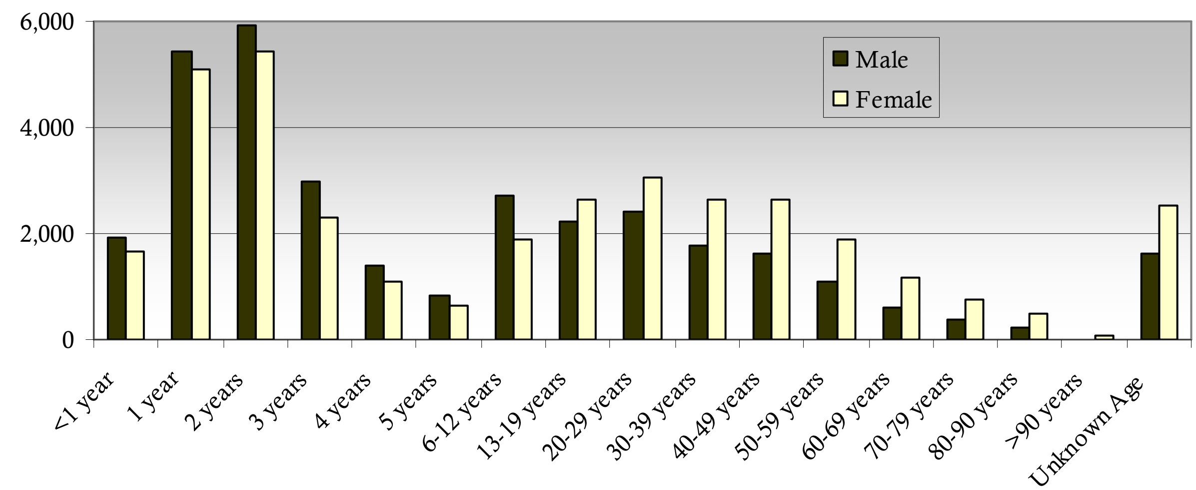
Virginia Poison Control Network

POISON Help
1-800-222-1222

The Virginia Poison Control Network (VPCN) provides poison information and consultative services to all residents and health care professionals in Virginia and is comprised of the three centers; the Blue Ridge Poison Center at the University of Virginia, the Virginia Poison Center at the Virginia Commonwealth University, and the National Capital Poison Center. They serve to decrease the morbidity, mortality and health care costs by reducing unnecessary outpatient visits and hospital admissions, as well as improve the quality of care provided to patients with accidental or self-poisoning.

All data included on the following five pages is taken from their annual report which includes data from 2007. Due to the fact that OEMS does not house the entire database, groupings such as age will not be consistent with those in other sections of this report.

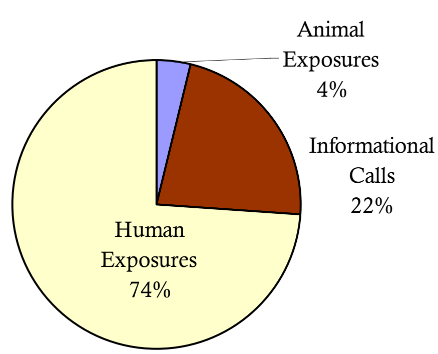
Age Distribution of VPCN Patients



Over 25% of all calls placed to Virginia poison centers during 2007 were calls for information and advice for animal exposures.

Calls for information should not be under-estimated because they help to prevent actual exposures by eliminating the chance of misuse of items that may cause injury.

VPCN Call Types

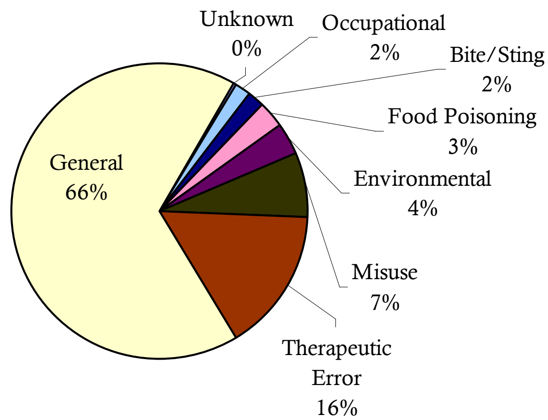


Virginia Poison Control Network

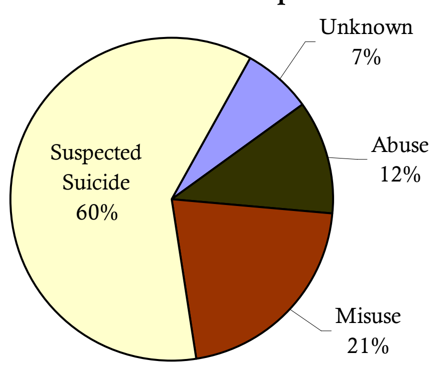
Poison exposures, like trauma, are grouped as unintentional or intentional. Unintentional exposure are "accidental poisonings" and can occur in residential, environmental, work or other settings. The use of the word "accidental" is no longer used to describe injuries because these injuries have a cause and that is typically a human behavior that could have been prevented.

Intentional causes of exposures are caused by suicide or attempts of suicide or purposeful misuse or abuse of substances.

Cause of Unintentional Exposures

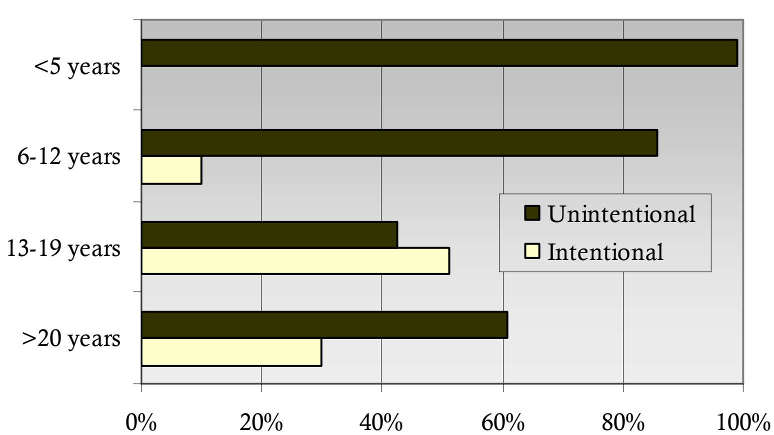


Cause of Intentional Exposures



Intent of Poison Exposures	
Intent	Frequency
Intentional	10,626
Unintentional	5,668
Adverse Reaction	2,255
Other	518
Unknown	352

Intentional v. Unintentional by Major Age Group



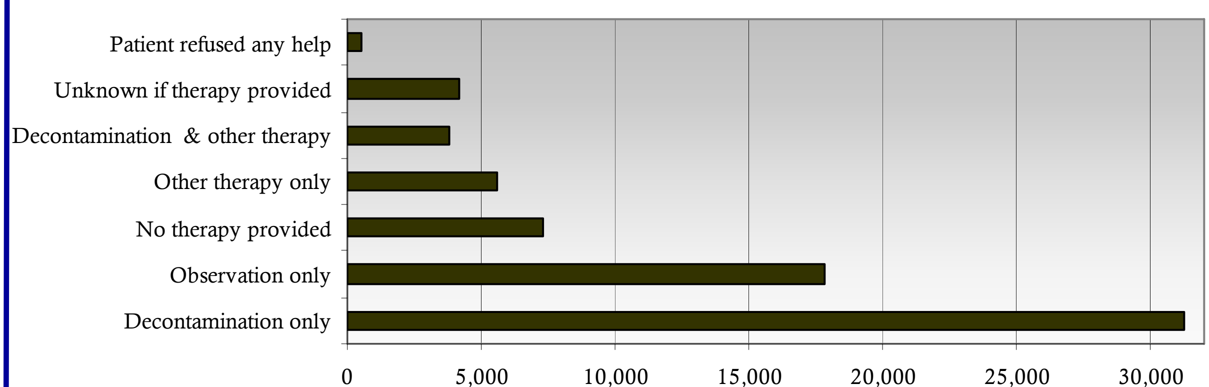
Poisoning can occur at any age and crosses all socio-economic boundaries. Toddlers and younger adults are the highest "at risk" groups for exposures.

Human exposures are also monitored by their intent; unintentional (accidental), intentional (suicide, misuse, or abuse), adverse reaction, or other.

Virginia Poison Control Network

The most frequent treatment provided is decontamination. Decontamination may include irrigating the stomach or use of charcoal or other oral medications to absorb or counteract poisons in the digestive tract. The use of these medications frequently acts as a cathartic also. Many patients require close monitoring as poison can affect one's cardiac rhythm, alertness, oxygenation, and other symptoms. Other therapies used to manage poison exposures may include administration of a variety of medications, antidotes, even hemodialysis.

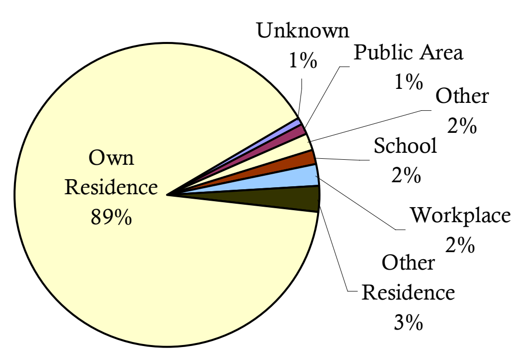
Treatments Provided to Exposure Patients



Management Site of Poison Exposures

Site	Frequency	Percent	
Managed on site/ non-health care facility	51,092	73%	
Evaluated, treated, and released	8,950	13%	Managed in Health Care Facility
Admitted to critical care unit	2,637	4%	
Patient lost to follow-up/left AMA	2,138	3%	
Admitted to psychiatric facility	1,955	3%	
Admitted to non-critical care unit	1,578	2%	
Refused referral	1,256	2%	
Other	558	<1%	
Unknown	255	<1%	

Location of Exposures



Most poison exposures (90%) occur in the home and the majority of those cases can be managed on-site avoiding needless emergency department visits. Of the patients that are seen in the hospital, the largest percentage of those are evaluated, treated as needed, and released from the hospital.

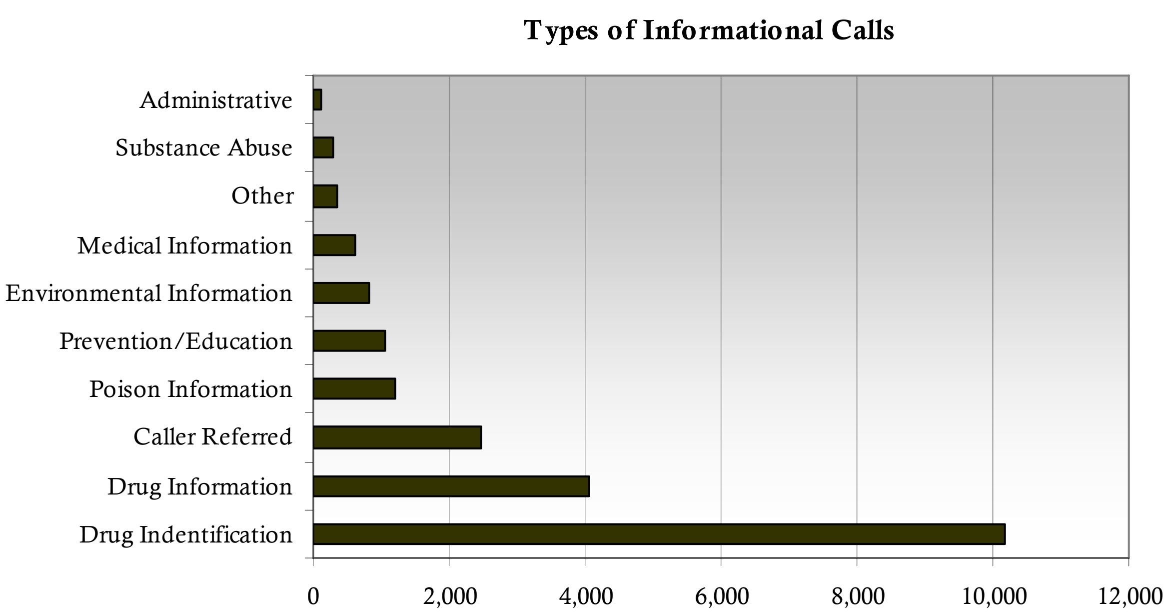
Virginia Poison Control Network

Route	Under 6 years	6-12 years	13-19 years	Over 19 years	Total
Ingestion	33,247	3,729	3,997	18,408	59,603
Inhalation/ Nasal	521	278	354	2,783	4,005
Dermal	1,928	357	247	2,067	4,622
Ocular	1,060	366	236	1,615	3,292
Bite/Sting	147	108	126	844	1,233
Parenteral	34	33	31	341	448
Other	45	13	14	109	182
Unknown	33	11	15	171	235

Route of Poison Exposures by Age

Ingestion (taking poison by mouth) of poisons remains the primary route of exposure throughout the lifespan. Whether intentional or unintentional most of these exposures are avoidable and demonstrate why poison prevention is such an important role that poison centers play through public education.

Through outreach education on poison injury prevention, the three centers work to decrease the overall occurrence of poisonings in Virginia. In FY08, the VPCN distributed 1.9 million poison prevention materials, presented at 314 health fairs, performed 126 media interviews, provided on-site training to 486 health professionals, and provided 386 professional education programs.

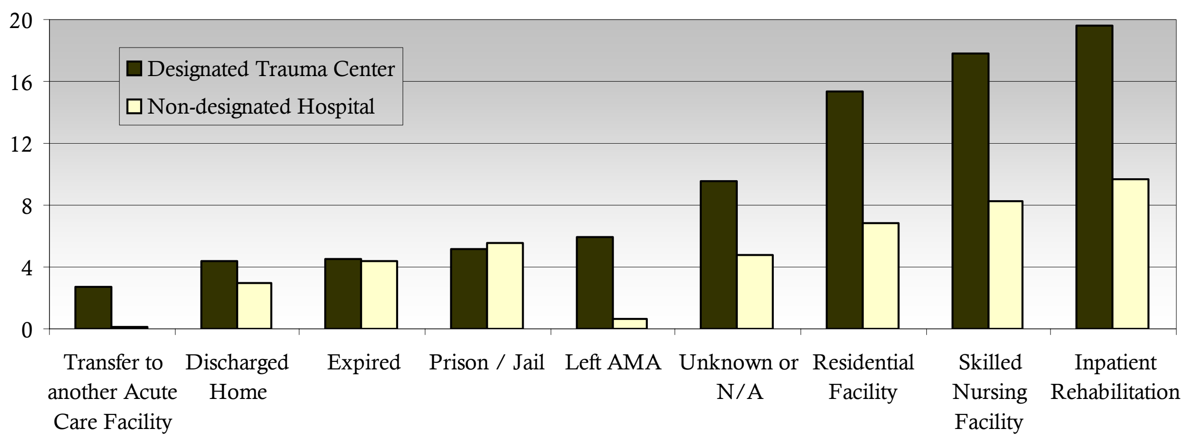


Brain and Spinal Cord Injuries

In the 2007 Virginia General Assembly session, the mandate for the Department of Rehabilitative Services (DRS) to collect data and maintain the Virginia Central Registry for Brain and Spinal Cord Injury, as required by § 51.5-11 of the *Code of Virginia*, was repealed. An amendment was made to § 32.1-116.1 of the *Code of Virginia* to allow OEMS to provide patient level data from the Virginia Statewide Trauma Registry (VSTR) to DRS. By doing this, DRS no longer has to autonomously collect and maintain a database, but can continue to conduct patient outreach programs. On July 1, 2008, OEMS began providing DRS with what will be quarterly copies of the VSTR patients with either brain or spinal cord injuries.

In 2007 there were 6,066 patients that met the criteria for a brain or spinal cord injury. 63% of the cases were male and the overwhelming majority (61%) were discharged home. The average GCS of the patients going to a designated trauma center was 12.4 and the average Glasgow Coma Score (GCS) of brain/spinal cord injured patients going to a non-designated hospital was 13.4.

Average Length of Stay (in days) by Outcome for Patients with Brain or Spinal Cord Injuries



Age Distribution of Patients with Brain or Spinal Cord Injuries