

Washington's Trauma System

Definition: A comprehensive statewide system providing injury prevention services and timely and appropriate delivery of emergency medical treatment for people with acute illness and traumatic injury.

Summary

Trauma is the leading cause of death for people ages 1–44 and the leading cause of years of potential life lost for all people ages 75 and younger.¹ The Washington Trauma Care System, which the state Legislature authorized in 1990, is a comprehensive and systematic approach to trauma care that includes injury prevention, prehospital emergency care, acute hospital care, rehabilitative services, and system monitoring and evaluation. Its goal is to prevent human suffering and to reduce the personal and societal burden resulting from trauma.

Introduction

Time is a critical factor in trauma care. There is a golden hour from the time of an injury during which a trauma system is most effective.

Trauma deaths cluster around three distinct times. The first is immediately after the event. About half of trauma deaths occur in this window. It is a particularly important time for people with trauma such as lacerations of the brain, spinal cord, or heart—injuries that are nearly always fatal. Rapid response by emergency medical services and advanced life support interventions can reduce these deaths.

The second peak is within the first few hours of injury, and it particularly affects people with severe blood loss or multiple injuries. With the level of medical care available today at designated trauma services, many of these deaths are preventable with the provision of timely care. These are the injuries most affected by emergency medical services (EMS) responses and improved resuscitation and care at a trauma center. About a third of all trauma deaths are in this category.

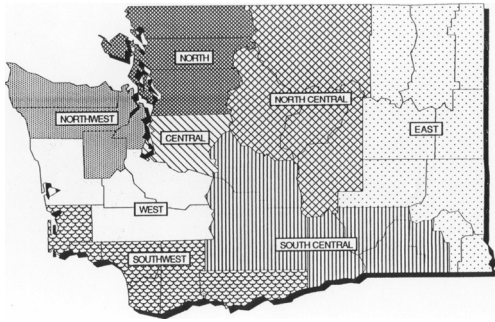
The third peak occurs days after an injury, and deaths usually result from organ failure or infection. Many of these deaths are also preventable, and while timing of care is important to survival, access to designated trauma services is the factor that most often determines survival at this stage.

Organized trauma systems can reduce the preventable trauma death rate by as much as 30% for patients who reach the hospital alive.^{2,3,4,5,6} Systematic reviews of published evidence support the effectiveness of trauma systems in reducing in-hospital mortality.^{7,8,9,10} Formal trauma systems provide a continuum of care, including injury prevention, EMS care, hospital resuscitation, stabilization and transfer, hospital definitive care, and rehabilitation services.

In 1990, the Washington Emergency Medical Services and Trauma Act authorized the development of the state's trauma care system. A systems approach is cost-effective, assures appropriate and adequate care, prevents human suffering, and reduces the personal and societal burden resulting from trauma.

There are eight regions in the Washington EMS and Trauma System and five levels of acute-care trauma services. The state's only Level I service (Harborview Medical Center) provides the highest level of resources for the most complex injuries or illness. Level V services are unique to Washington and represent the role that small rural hospitals and clinics play in the trauma system. Level V trauma services offer resources to assess, resuscitate, stabilize, and transfer major trauma patients. Levels II through IV maintain varying resources and capabilities that fall between those of Level I and V. Among Washington's acute care hospitals, 85% are designated to provide some level of trauma service.

EMS and Trauma Care Regions



The Washington EMS and Trauma System starts with prevention efforts to reduce the incidence of injury. It continues with timely and appropriate delivery of prehospital and hospital emergency medical treatment and definitive care for people who are injured. The final element is access to appropriate rehabilitation following acute treatment.

Although the goal of optimal care is the same statewide, the trauma system recognizes that flexibility is essential to achieving this goal in each community. Every two years, each of eight EMS and Trauma Care Regional Councils prepares a plan to achieve overall goals within its boundaries, subject to Department of Health review and approval.

Ultimately, the mission of any trauma system comes down to this simple maxim: Get the right patient to the right resources in the right amount of time. Several broad strategies help accomplish this task.

Prehospital verified trauma services. The Department verifies the capabilities of licensed EMS agencies that make an extra commitment to trauma care by meeting specific standards of personnel training, equipment availability, and response time. The Department currently licenses 502 EMS agencies, including 461 agencies with verification to provide trauma care.

In addition to ground ambulances, Washington's air ambulances are located so that 68% of the state's land area and nearly 91% of its population are within 30 minutes of an air-ambulance base-station and within 30 minutes of a Level I or II designated trauma services. Air ambulances are dependent on weather conditions, with reduced access during periods of bad weather. (See the description of these services in Technical Notes.)

Prehospital patient care procedures (PCPs).

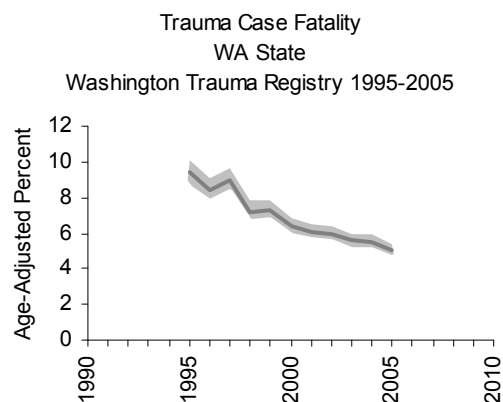
PCPs are guidelines that address the basic questions raised by any medical emergency. Each EMS and trauma care region¹¹ develops PCPs and submits them to the Department for review and approval.

One significant aspect of trauma care is the appropriate triaging or sorting of trauma patients. A key component of the PCPs are trauma triage and destination procedures, a simple decision tree that is used statewide to assess a trauma patient's condition and direct the patient to the appropriate level of trauma care in the right amount of time.

Designation of trauma services. Designated trauma services provide definitive care for trauma patients, including resuscitation, stabilization, diagnosis, surgery, intensive care, and rehabilitation. Hospitals with different levels of designation differ in the types of services offered and the availability of rehabilitation services to assure optimal post-acute staffing, equipment, and training, with Level I providing the most comprehensive care, 24 hours a day, seven days a week. Standards for pediatric trauma care address the special needs of children. In addition to 80 designated trauma hospitals, Washington currently has 12 designated trauma rehabilitation services to assure optimal post-acute care.

Time Trends

One measure of trauma system effectiveness is in-hospital case fatality. Hospital trauma data are available from the Washington Trauma Registry.

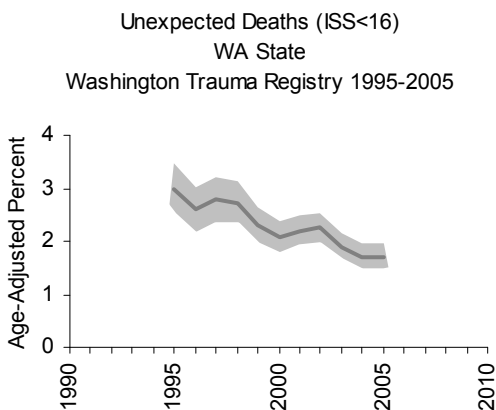


The chart above shows the change in the death rate (number of deaths divided by number of reported traumas) during 1995–2005. During this time, 7,058 deaths occurred out of 108,216 reported trauma

cases. In 1995, the rate was 9%, and by 2005, it had fallen to 5%.

The Injury Severity Score (ISS) categorizes trauma severity. Injuries with an ISS of less than 9 are mild (e.g., simple laceration, contusion, or loss of consciousness). An ISS from 9 to 15 indicates a moderate injury (e.g., fractured leg), while an ISS of 16 to 39 indicates a major injury (e.g., head injury and intra-abdominal injury). Severe trauma refers to those injuries with an ISS of 40 or greater (e.g., two or more major body parts injured). Most patients with less-severe injuries (ISS of less than 16) survive them, barring extenuating circumstances including extremes of age or complicating preexisting conditions such as heart or respiratory disease. Similarly, a higher percentage of severely injured patients (ISS of 40 or greater) will die despite the best of prehospital and hospital care. These *unexpected outcomes* (death at one end of the severity scale, survival at the other) also serve as measures of the impact of systematized trauma care.

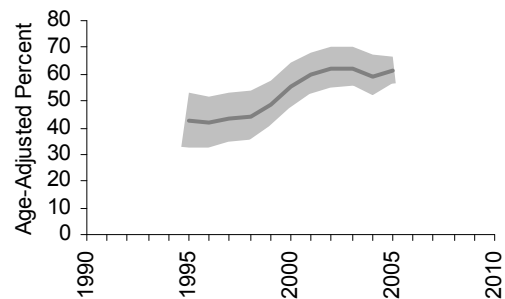
The chart below shows the change in case fatality for unexpected death during 1995–2005. During this period, 1,839 deaths occurred out of 83,930 patients with mild and moderate injuries.



In 1995, 3% of patients with mild and moderate injuries died; by 2005, less than 2% died.

Unexpected survivors are patients admitted with an ISS of 40 or greater. The chart below shows the survival proportion for patients expected to die based on their injuries. In 1995, 42% of these patients survived; by 2005, 61% survived.

Unexpected Survivors (ISS≥40)
WA State
Washington Trauma Registry 1995-2005



Year 2010 Goals

Healthy People 2010 goals for traumatic death or injury are not established. Goals for many causes of trauma, such as motor vehicle crashes and falls, are discussed in the Injury and Violence chapters.

Geographic Variation

Trauma care requires intense use of health services. Highly skilled and well-equipped prehospital and hospital care providers must be available at all times to achieve timely, optimal care. These resources are not equally available across Washington.

The geography of rural areas, such as difficult terrain and unwitnessed injury, creates unique challenges for trauma care. Long transport times, training of prehospital personnel, fewer available physicians, and limited exposure to trauma patients may contribute to the poor prognosis of the rural trauma patient.^{12,13,14} A reliance on volunteer EMS providers and a tendency to privately transport family members to local hospitals also add to the challenges of rural trauma care. Rural hospital factors that might contribute to the excess mortality in rural areas include limited diagnostic capabilities and delayed or incomplete surgical capabilities.^{15,16,17,18} Several studies report that many rural trauma deaths are preventable, with evidence that inappropriate emergency department care related to airway and chest injury management is a major contributor.^{19,20,21}

While response times are critical in any trauma incident, they are particularly important and challenging in rural and wilderness areas. Precious minutes often pass before discovery of a crash on a rural road. Long distances to the scene and subsequent transport to a trauma hospital can both contribute to delays in the provision of medical treatment. Response time standards vary from eight

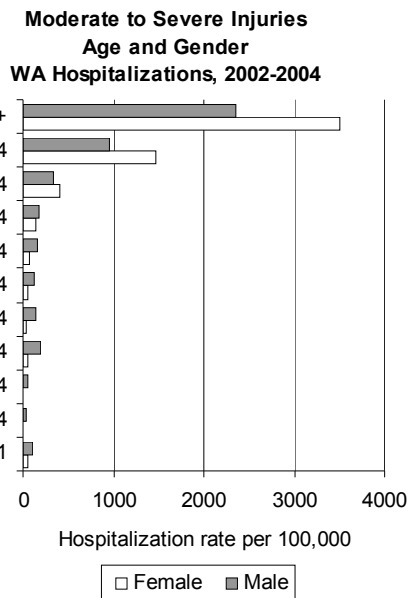
minutes in urban areas to 45 minutes in rural settings.

Along with time and distance challenges in rural and wilderness areas, the lack of full-time, paid prehospital providers creates additional barriers to care. Small, rural communities often rely on volunteers to respond to trauma incident and other medical emergencies. About half of Washington’s certified emergency medical technicians and first responders are volunteers, but rural providers are much more likely to be volunteers than are providers in urban settings.

Rural hospitals serve a vital role in trauma care, but they usually are not the final destination for severely injured patients. Local resources in rural areas help assure that patients receive appropriate resuscitation and stabilization prior to transfer for definitive care.

Age and Gender

Trauma affects people of all ages. Rates are greatest among women ages 65 and older, due primarily to injuries from falls. At ages younger than 65, trauma is more common among males. The largest number of major and severe trauma cases occurs among young men ages 15 to 24, with 40% of these injuries due to traffic-related incidents.



Race and Ethnicity

Data on race and ethnicity are missing for more than 20% of trauma patient records and as such are not presented here.

Income and Education

The trauma registry does not include data on patient income or education.

Risk and Protective Factors

Injury prevention. Many injuries are preventable. Effective injury prevention strategies include a combination of product, environmental, behavioral, and legal interventions for specific types of injuries and at-risk populations. Effective strategies include products such as seat belts, car seats, and smoke alarms; environmental changes include speed bumps, pool fencing, and residential fire sprinklers; behavioral and communication strategies include programs directed to seniors to prevent falls and parent training to prevent childhood injury; and policies or laws include defining permissible blood alcohol levels and strong enforcement of current traffic and boating laws. (See the [Injury and Violence section](#) for additional information on injury prevention.)

Costs and reimbursement levels. One barrier to access to high-quality trauma care services is the reluctance of providers—ambulances and aid services, hospitals, and physicians—to participate in the system because of the high cost of providing trauma care and low reimbursement rates. Low Medicaid reimbursement in particular creates a disincentive for hospitals and physicians in areas with high Medicaid enrollment.

Physician specialist availability. Washington’s goal is to maintain at least one Level I or II trauma hospital in each EMS and trauma care region. Due to the limited availability of specialty providers such as neurosurgeons and orthopedic surgeons, three regions are without a Level I or II trauma hospital and a fourth region is at risk of losing its Level II hospital in the near future.

Intervention Strategies

The Washington EMS and Trauma System is itself an intervention. To improve the system, certain additional elements are needed.

Enhanced reimbursement. Trauma centers must be ready to receive patients at all hours of the day and night. The cost for a Level I or II trauma center to assure readiness exceeds \$2 million per year.²² Low Medicaid reimbursement rates and a growing uninsured population create disincentives for hospitals and physicians to participate in the trauma system. In 1997, the Washington Legislature established the Trauma Care Reimbursement Fund, which receives funds from a surcharge to moving

violation fines and to motor vehicle sales and leases. The fund provides grants to prehospital and hospital providers and allows for enhanced reimbursement rates for Medicaid trauma patients. The Department of Health continues to work closely with the Department of Social and Health Services in planning and managing distribution of the funds, which total more than \$20 million per year.

Regional quality improvement programs. To provide continuous monitoring and evaluation of quality of care for trauma patients, the Department establishes and supports ongoing quality improvement committees in each of the eight EMS and trauma care regions. This support enables prehospital and hospital providers to conduct joint and confidential review of trauma care, addressing both individual patient care and system-wide design and management issues.

Trauma clinical practice guidelines. To reduce variability of care and improve clinical outcomes, Washington's Trauma Medical Directors developed a series of clinical practice guidelines on topics such as blunt aortic injury, cervical spine injuries, major pelvic fractures, liver and spleen injuries in children, and blunt cardiac trauma. The Department endorses these guidelines and disseminates them to all designated trauma services in an effort to reduce variability of care and increase adoption of evidence-based medicine.

Washington Trauma Registry (WTR). The WTR provides data for rational and unbiased review for system planning and management. The WTR collects detailed demographic and clinical data on major trauma patients from prehospital agencies and trauma-designated acute care and rehabilitation services. The information supports systems evaluation and quality improvement activities at local, regional, and state levels. Linkage of patient information from prehospital, acute, and rehabilitation phases of care—an innovative aspect of the WTR – allows each phase of care to be examined independently as well as for the entire course of patient management to be assessed.

Washington EMS Information System (WEMSIS). The Department is developing a statewide EMS patient care database to promote evidence-based decision-making and EMS quality improvement. The WEMSIS will be useful for evaluating EMS patient care

outcomes, developing evidence-based training curricula and medical protocols, and monitoring and evaluating EMS system response and performance. When fully implemented, this system will capture data on the 700,000 EMS calls received each year.

Prehospital continuing education. Providing adequate initial training and continuing education to providers in rural areas presents a special challenge. A volunteer's time is limited, the sponsoring agencies' resources are finite, and travel distances are significant. These factors all contribute to difficulties recruiting and retaining an adequate number of properly trained EMS personnel in rural settings.

In response to this situation, an ongoing training and evaluation program (OTEP) is available for EMS personnel to meet the education requirements and core topic content for recertification. While allowing providers to train in their local areas, OTEP includes cognitive, affective, and psychomotor evaluations following completion of each topic presentation to determine student competence of topic content. Regularly scheduled OTEP offerings ensure that EMS personnel maintain their knowledge base and patient care skills proficiency

See Related Chapters: [Hospitalization](#), [Motor Vehicle Crashes](#), [Traumatic Brain Injury](#), [Falls Among Older Adults](#), [Poisoning and Drug Overdose](#), [Drowning](#), [Suicide](#), [Homicide](#), [Youth Violence](#), [Domestic Violence](#), [Child Abuse and Neglect](#)

Data Sources

Washington State Trauma Registry, Office of Emergency Medical and Trauma Prevention, Department of Health
Hospitalization data with Injury Severity Score, compiled by the Washington State Department of Health, Office of Emergency Medical and Trauma Prevention, using data from the Washington Comprehensive Hospitalization Abstract Reporting System (2002–2004) and ICD MAP-90 injury severity coding software developed by Johns Hopkins and Tri-Analytics (1990).

For More Information

Office of Emergency Medical Services and Trauma System
(800) 458-5281, <http://www.doh.wa.gov/hsqa/emstrauma/>

Technical Notes

The Trauma Registry reports on trauma, not on all injuries. The trauma inclusion criteria are: an injured patient (ICD-9 codes 800-904.9 and 910-959.9) who is admitted to a hospital for more than 48 hours (or any admission for a child through age 14) or who is transferred from the first receiving facility to another hospital, or for whom the hospital's trauma resuscitation team is activated, or who dies in the hospital. These inclusion criteria

identify injured patients who could most benefit from an effective trauma system while balancing the depth of the information available against the cost of acquiring it. Trauma deaths occurring out of hospital are not included in the registry, with the exception of those who die in transport.

Injury Severity Score: This is a summary score for traumatic injuries. The ISS is calculated as the square of the abbreviated injury score (AIS). If more than one injury occurs, the highest AIS value is selected from each of up to six body regions (head/neck, face, thorax, abdominal and pelvic contents, limbs, and skin). The three highest of these are squared and summed. If any AIS score is six, then the ISS is 75. The ISS ranges from one (least severe) to 75 (usually fatal). See Champion, Sacco, Copes: Injury Severity Scoring Again. *Journal of Trauma* 38:94, 1995.

Endnotes

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¹¹ The EMS and Trauma Care Regional Councils are: Central (King County), East (Adams, Asotin, Ferry, Garfield, Lincoln, Pend Oreille, Spokane, Stevens, and Whitman counties), North (Island, San Juan, Skagit, Snohomish, and Whatcom counties), North Central (Chelan, Douglas, Grant, and Okanogan counties), Northwest (Clallam, Jefferson, Kitsap, and Mason counties), South Central (Benton, Columbia, Franklin, Kittitas, Walla Walla, and Yakima counties), Southwest (Clark, Cowlitz, Klickitat, southern Pacific, Skamania, and Wahkiakum counties), and West (Grays Harbor, Lewis, northern Pacific, Pierce, and Thurston counties).

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¹³ Gonzalez, R. P., Cummings, G., Mulekar, M., & Rodning, C. B. (2006). Increased mortality in rural vehicular trauma: identifying contributing factors through data linkage. *Journal of Trauma*, 61(2), 404-409.

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