

# Epidemiology of Trauma



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## Key Points

1. Trauma is the leading cause of death for children. It is the prime reason for years of life lost and medical costs in the care of children.
2. Homicide and suicide are more common causes of death for teenagers.
3. Abuse is often a lethal disease for infants.
4. Head injury mixed with another traumatic injury results in an increased chance of death.
5. Males are more likely than females to have injuries involving higher energy transfer, while less likely to use protective devices. They are also more likely to be injured deliberately.
6. Unintentional falls are the leading cause of nonfatal injuries.

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## 1. Epidemiology by body region

### a. Head

- i. In ages less than 2 years old, physical abuse is the most common cause of head injury.
- ii. A child's brain doubles in size during the first 6 months of life and reaches 80% of an adult's brain size by 2 years old.
- iii. In children 3 years old and above, the three most common head injury mechanisms are:
  1. Motor vehicles
  2. Bicycle crashes
  3. Falls
- iv. Children are five times more likely to have apnea, hypoventilation, and hypoxia from blunt trauma to the brain than they are to have hypovolemia-associated hypotension. Pulmonary failure is common; Cardiac failure is uncommon and is usually secondary to pulmonary failure.

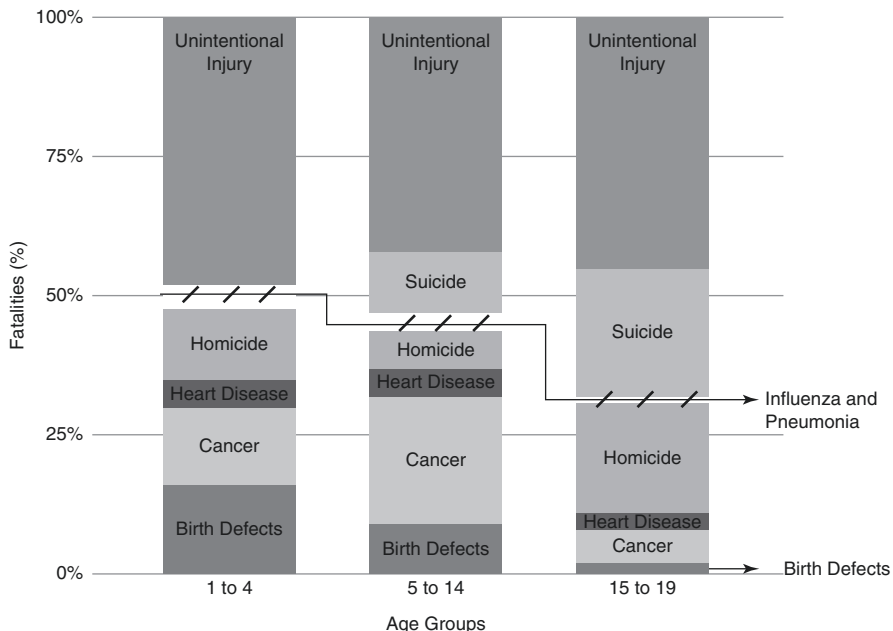
### b. Cervical spine

- i. Cervical spine injuries comprise 80% of spinal trauma in pediatrics. Children are 2.5 times more likely than adults to suffer a C-spine injury due to large head size and a highly flexible spine.
- ii. Ligamentous injuries are more common than fractures.
- iii. Hyperflexion injuries (anterior wedge fractures and posterior disruption) are more common than hyperextension (compression of posterior and anterior disruption of the longitudinal ligament).
- iv. The upper cervical spine (C1–C3) is the most vulnerable site in children under 8 years old.
  - v. Symptoms are delayed in up to 25% of children with cervical spine injuries, with symptoms typically presenting 30 min to 4 days later.
  - vi. Pseudo-subluxation of C2 on C3 is a normal finding for up to 38% of children under 7 years old and in 20% of children up to 16 years old.
  - vii. Children are more likely than adults to sustain spinal cord injury without radiographic abnormality (SCIWORA). A normal cervical spine series may be present in two-thirds of children with spinal cord injuries.

### c. Thoracic

- i. Occurs infrequently in children: Approximately 5–12% of pediatric trauma patients. However, thoracic injuries are second only to head trauma as the most common cause of death for these patients.

- ii. Around 85% of thoracic trauma cases are due to blunt forces, with motor vehicle accidents as the most common source.
  - iii. Penetrating thoracic injuries are less common yet carry a 15% mortality rate.
  - iv. Pulmonary contusion is the most common thoracic injury in a child.
  - v. More than 80% of children with pulmonary contusions also have extra-thoracic injuries; thus, mortality rates for children with pulmonary contusions can be as high as 22%.
- d. Abdominal
- i. Eighty percent of abdominal injuries are due to blunt force.
  - ii. Isolated abdominal injuries are most common.
  - iii. The spleen is the most commonly injured abdominal organ.
  - iv. Solid organ injuries of the abdomen typically occur by one of two mechanisms: direct blow or high energy injuries (motor vehicle, all-terrain vehicle, and fall from a great height).
  - v. Renal injuries in children are less common (rare under age 5 years old) due to anatomical differences, seen in approximately 10% of all pediatric blunt abdominal trauma.
  - vi. Multi-system abdominal injuries carry mortality as high as 12%.
- e. Pelvic
- i. Most commonly related to high-energy mechanisms. Pedestrian struck by motor vehicle is the most common mechanism.
  - ii. Occur less frequently in children versus adults (1.6% of all pediatric trauma admissions).
  - iii. Children have a lower mortality rate from pelvic hemorrhage than adults due to anatomical differences.
  - iv. Pelvic ring disruption and avulsion injuries are more commonly reported as they can occur with lower energy impacts.
  - v. Injuries commonly associated with pelvic injuries:
    - 1. Hemorrhage from other injuries
      - a. Up to 30% of patients require blood transfusion(s) due to hemorrhage from an associated injury.
    - 2. Head injury: Up to 40%
    - 3. Chest/abdomen: 15–33% association
    - 4. Genitourinary: 11–12%
    - 5. Neurologic: Up to 6%
    - 6. Extremity: 18% (femur and tibia most common) (Fig. 1)



**Fig. 1** Pediatric fatality by type and age. (Source: Emily Steinhilber)

### Additional Notes

While epidemiology can be a dry subject, the data tracked by trauma registries is highly useful. Epidemiologic information pertaining to trauma has helped direct public health initiatives, thus helping countless children. Initiatives that focus on prevention will save far more lives than those that focus on treatment.

Advanced trauma life support (ATLS) guidelines are essential in the care of pediatric trauma patients, to try and make as many as possible of pediatric injuries survivable. Communication between pre-hospital providers and Trauma Center staff is key to maximize the opportunity to reverse correctible threats to life during the initial “Golden Hour” after injury.

Understanding regional differences in trauma epidemiology is useful in the evaluation of the pediatric trauma patient. For example, nine out of ten children under age 15 that are killed by firearms live in the United States. Differences in regional injury patterns are seen when comparing one geographic terrain to another, e.g., one city to another or urban versus rural. This data can be used to guide transfer and treatment decisions at any Trauma Center.

## Study Questions

1) The leading cause of death in children is \_\_\_\_\_.

- a) Splenic injuries
- b) Acute lymphocytic leukemia
- c) Trauma
- d) Cancer

Answer: (c) Trauma. For children, trauma is a greater cause of mortality than any other etiology for all ages. It is greater cause of mortality than the next three causes of death combined.

2) Children are 2.5 times more likely than adults to suffer a/an \_\_\_\_\_ injury due to large head size and a highly flexible spine.

- a) Cervical spine
- b) Liver
- c) Thoracic spine
- d) Ophthalmic

Answer: (a) Cervical spine. In children, in particular infants and small children, the head represents a greater portion of body surface area and weight as compared to adults. Blunt traumas that involve deceleration cause the weight of the head to pitch forward or back and exert force on the cervical spine.

3) \_\_\_\_\_ abdominal injuries carry a mortality rate as high as 12%.

- a) Pediatric
- b) Multi-system
- c) Missed
- d) Unfounded

Answer: (b) Multi-system. When a child suffers multi-system trauma, the risk of death is greater than if any one system is injured alone. Head injury combined with hemorrhagic shock is particularly lethal.

4) Under the age of 2 years old, \_\_\_\_\_ is the most common cause of head injuries.

- a) Fall
- b) Physical abuse
- c) Motor vehicle collision
- d) All-terrain vehicle accident

Answer: (c) Physical abuse. Providers who treat children must have a high index of suspicion for non-accidental trauma. As the history of the trauma can be absent or erroneous, non-accidental trauma can be missed if not actively investigated. Children under the age of 2 years old are not typically involved in activities involving high forces of energy, as is more common in adolescents. Severe head injury in a young child requires consideration of child abuse as an etiology, especially if there is no clear explanation of how the injury was caused.

## Further Reading

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