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A 15 year cohort review of in-hospital pediatric trauma center mortality: A catalyst for injury prevention programming

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ABSTRACT

Background: The objective of our study was to identify the most common mechanisms of injury leading to death in our pediatric population.

Methods: A retrospective cohort of fatally injured children 0–17 years old treated at our trauma center during 2000–2015.

Results: The mortality rate in our population was 8% (n = 103). Fifty-five percent were male. The majority (76%) of fatal injuries were blunt. Overall, motor vehicle collisions (MVCs) were the most common mechanism of injury (61%), followed by assault/abuse (9%). Of the deaths caused by MVCs, 37 (59%) were occupants, 11 (17%) were pedestrians, and 6 (10%) were cyclists. In the infant sub-population, assault/abuse was the most common mechanism of injury.

Conclusion: MVCs were the leading cause of death in this population. In the infant subpopulation (<1 year), abusive head trauma emerged as the leading mechanism. Injury prevention programming should target abusive head trauma in infants and teen road safety.

Summary: A 15 year cohort review of pediatric trauma center mortality. Common mechanisms of injury leading to death were identified.

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1. Background

In Canada, the implementation of national and provincial injury prevention initiatives over the past two decades have been shown to correlate with a downward trend in the rate of pediatric trauma mortality.¹ However, trauma remains the leading cause of mortality in the pediatric population and in 2011 over 800 children still died from trauma-related injuries.^{2,3}

Previous analysis of pediatric trauma in Ontario has revealed in-hospital mortality rates ranging from 4% to 8% and overall mortality ranging from 3 to 12 per 100,000.^{4–6} Common mechanisms of injury have also been identified and include: motor vehicle collisions (MVCs), pedestrian or cyclist struck, falls, and abuse.^{4–7}

The Children's Hospital at London Health Sciences Centre (CH-

LHSC) provides the services of a Level I Pediatric trauma center as defined by the Trauma Association of Canada.⁸ Emergency department staff at CH-LHSC have specialized training in pediatric resuscitation. Additionally, pediatric general surgery, as well as other surgical subspecialties including orthopedics, neurosurgery, and plastic surgery, are available 24 h a day with a maximum response time of 30 min from time of call. Management of seriously injured children and adolescents at dedicated pediatric trauma centers has been associated with reduced mortality.^{9–11} However, ongoing analysis of regional trauma populations is required to further improve acute care of injured patients, optimize integrated trauma systems, and develop effective injury prevention programs.

The objective of this study was to identify the most common mechanisms of injury leading to death in the pediatric population in Southwestern Ontario, so that injury prevention initiatives can be focused effectively. This study was approved by Western University's Health Sciences Research Ethics Board (REB# 107066).

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2. Methods

This study was a retrospective cohort study of all children and adolescents under 18 years of age who died following treatment at the CH-LHSC for a severe injury, over a 15 year period, from January 1st, 2000 to June 1st, 2015. This was a single-center study of a Level I Pediatric trauma center for Southwestern Ontario, Canada. CH-LHSC serves a geographic area of 19,000 square kilometers with a pediatric population of over 400,000. Inclusion criteria were: treated at CH-LHSC, age up to and including 17, an Injury Severity Score (ISS) greater than or equal to 12 or trauma team activation, and died in-hospital as a result of their injuries, including those who died in the emergency department.

Data were obtained from the CH-LHSC trauma database, which are collected prospectively by trained and experienced data analysts. The data undergoes institutional and provincial quality edit checks. For each patient in the study population, data were collected on demographics, and characteristics of the injury and the death. Clinical assessment scale values including Glasgow Coma Scale (GCS), ISS, and Pediatric Trauma Score (PTS) were also collected.

Descriptive statistics were produced for the following age categories: infants (age < 1 year), toddlers (1–4 years), school age (5–9 years), early adolescents (10–14 years), and late adolescents (15–17 years). All analyses were performed with Excel (Microsoft Corporation, Excel 2013, 15.0.4641.1000, Mountain View, CA) and IBM® SPSS® Statistics v23 (IBM Corporation, Armonk, NY).

3. Results

Between January 1st, 2000 and June 1st, 2015 there were 1298 pediatric trauma admissions to CH-LHSC. Of these, there were 103 mortalities, all of which met the criteria for inclusion in the study. Thus, the mortality rate for the study population was 8%.

3.1. Overview of fatal injuries and distribution by age and sex

Of the 103 pediatric trauma mortalities, 57 (55%) were male and

Table 1
Characteristics of the Pediatric In-Hospital Death cohort, 2000–2015 treated at Children's Hospital, London Health Sciences Centre.

Characteristic	Number (%)
Age (in years)	
>1	14 (13.6%)
1–4	16 (15.5%)
5–9	15 (14.6%)
10–14	20 (19.4%)
15–17	38 (36.9%)
Gender	
Male	57 (55.3%)
Female	46 (44.7%)
Injury Severity	
ISS	Median (IQR) 34 (26–45)
PTS	2 (1–3)
Mechanism of Injury	
Motor Vehicle Collision	63 (61.2%)
Fall	4 (3.9%)
Drown	8 (7.8%)
Assault/Abuse	9 (8.7%)
Burn	7 (6.8%)
Suicide	6 (5.8%)
Other	6 (5.8%)
Intentionality	
Non-intentional	84 (81.6%)
Self-inflicted	7 (6.8%)
Assault/Abuse	10 (9.7%)
Unknown	2 (1.9%)

the median age was 11 years (IQR: 2–16) (range: 0–17), as depicted in Table 1. The proportion of trauma deaths was inversely related to age with 37% of mortalities between ages 15–17 years, 19% between 10 and 14 years, 15% between 5 and 9 years, 15% between 1 and 4 years and 14% were less than 1 year old.

3.2. Mechanism of injury

Eighty-four (82%) of the mortalities occurred after non-intentional injuries, 10 cases (10%) occurred after assault/abuse, and 7 (7%) occurred after self-inflicted injuries (Table 1). Blunt mechanisms accounted for 78 (76%) of the trauma mortalities, whereas penetrating injuries were exceedingly rare, accounting for only 2 (2%) deaths over the 15 year study period. Drowning and asphyxiation were responsible for 13 (13%) of the deaths, and burns accounted for 7 (7%) deaths. The specific incidences of all traumatic etiologies resulting in death in each age group are presented in Fig. 1.

In ages 1–17 years, MVC-related injuries were most common, responsible for over two-thirds (n = 60; 68%) of mortalities in this age group. In ages 15–17 years, MVC related injuries accounted for the vast majority (89%) of injuries leading to death. A similar distribution of injuries was found in the 10–14 year old age group as well as in the 5–9 year old age group. In the 1–4 year old age group, MVC related injuries were still the leading cause of mortality (38%), however, burns were also found to be a common mechanism of injury accounting for 25% of the deaths in this age group. In infants <1 year of age, abusive head trauma (AHT) was the most common type of injury causing death, accounting for 8 (57%) of the fatalities in this age group.

3.3. Injury profile and measures of injury severity

The median ISS of patients who died was 34 (IQR: 26–45). Pediatric trauma scores were available for 61% of cases and the median PTS was 2 (IQR: 1–3). The distribution of Abbreviated Injury Scale (AIS)¹² scores for the nine body regions, along with the median ISS, are presented in Fig. 2. In 80 (78%) of the cases, the head was the most severely injured body region. External injury was the most severe injury in 7 (7%) cases (all burns), the thorax in 7 (7%), the abdomen in 6 (6%), and the spine in 4 (4%).

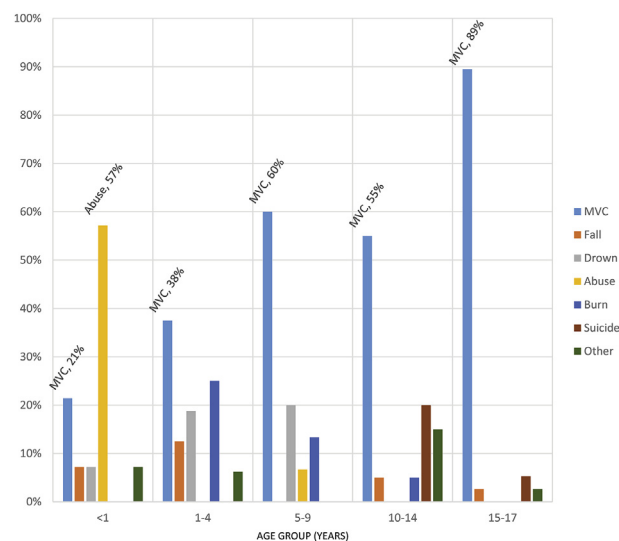


Fig. 1. Mechanisms of Injury for Pediatric In-Hospital Deaths by Age Group, 2000–2015 treated at Children's Hospital, London Health Sciences Centre.

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