

# Trends in Pediatric Nonfatal and Fatal Injuries

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Recent trends in pediatric injury-related fatalities are alarming,<sup>1</sup> with increases in homicides, suicides, and poisonings in the past decade. However, it is difficult to accurately assess the root cause of these trends in pediatric injury-related deaths without placing them in the context of all childhood injuries (ie, inclusive of nonfatal injuries). The analysis of nonfatal injuries can provide valuable insights into the circumstances and mechanisms of injury, which can help further develop effective preventive strategies to reduce both fatal and nonfatal injuries. Most studies to date have compared fatal and nonfatal injuries related to a specific mechanism such as firearm-related injuries<sup>2</sup> or intent such as self-harm.<sup>3</sup> Although these studies are informative, a broader lens is also useful to accurately predict general trends of pediatric injury. Here, we compared trends in fatal and nonfatal injuries in children, across intent and mechanism of injury.

## METHODS

Fatal (2011–2021) and nonfatal injury (2011–2020) data for children aged <18 years were derived from the Centers for Disease Control and Prevention, the National Center for Health Statistics' Web-based injury statistics query and reporting system (WISQARS). Fatal injury data in WISQARS are based on death certificates from the National Vital Statistics System. WISQARS provides exact death counts and death rates for the United States by age, intent, and mechanism. Nonfatal injuries presented in WISQARS provide national estimates on the basis of weighted data from the US Consumer Product Safety Commission's National Electronic Injury Surveillance System. Case fatality rates were calculated as the percentage of injuries that were fatal for each intent or mechanism. Linear regressions were used to evaluate time trends in fatal and nonfatal injury rates on the basis of intent and mechanism. The study is exempt from the institutional review board.

## RESULTS

At the beginning of the study period in 2011, fatal injury rates were 14.07 per 100 000 children and increased to 17.30 per 100 000 by 2021 ( $P = .006$  for linear trend). In contrast, nonfatal injuries decreased from 11 592.56 per 100 000 to 5359.73 per 100 000 in 2020 ( $P < .0001$ ) (Fig 1A). Nonfatal unintentional injuries and assaults decreased (54.9% and 59.8%, respectively,  $P < .0001$ ), whereas nonfatal self-harm injuries increased by 57.1% ( $P < .0001$ ) (Fig 1B). Firearm fatalities increased by 87.1%, drug poisoning fatalities increased by 133.3%, and suffocation-related fatalities increased by 12.5% (Fig 1C). At the same time, although the leading causes of nonfatal injuries decreased across most mechanisms (52.8% decrease in injuries from falls,  $P < .0001$ ; a 66.7% decrease in injuries from overexertion,  $P < .0001$ ; a 63.0% decrease in struck by against injuries,  $P < .0001$ ; a 47.3% decrease in motor vehicle occupant injuries,  $P = .005$ ; a 36.7% decrease in cut/pierce injuries,  $P < .0001$ ), nonfatal

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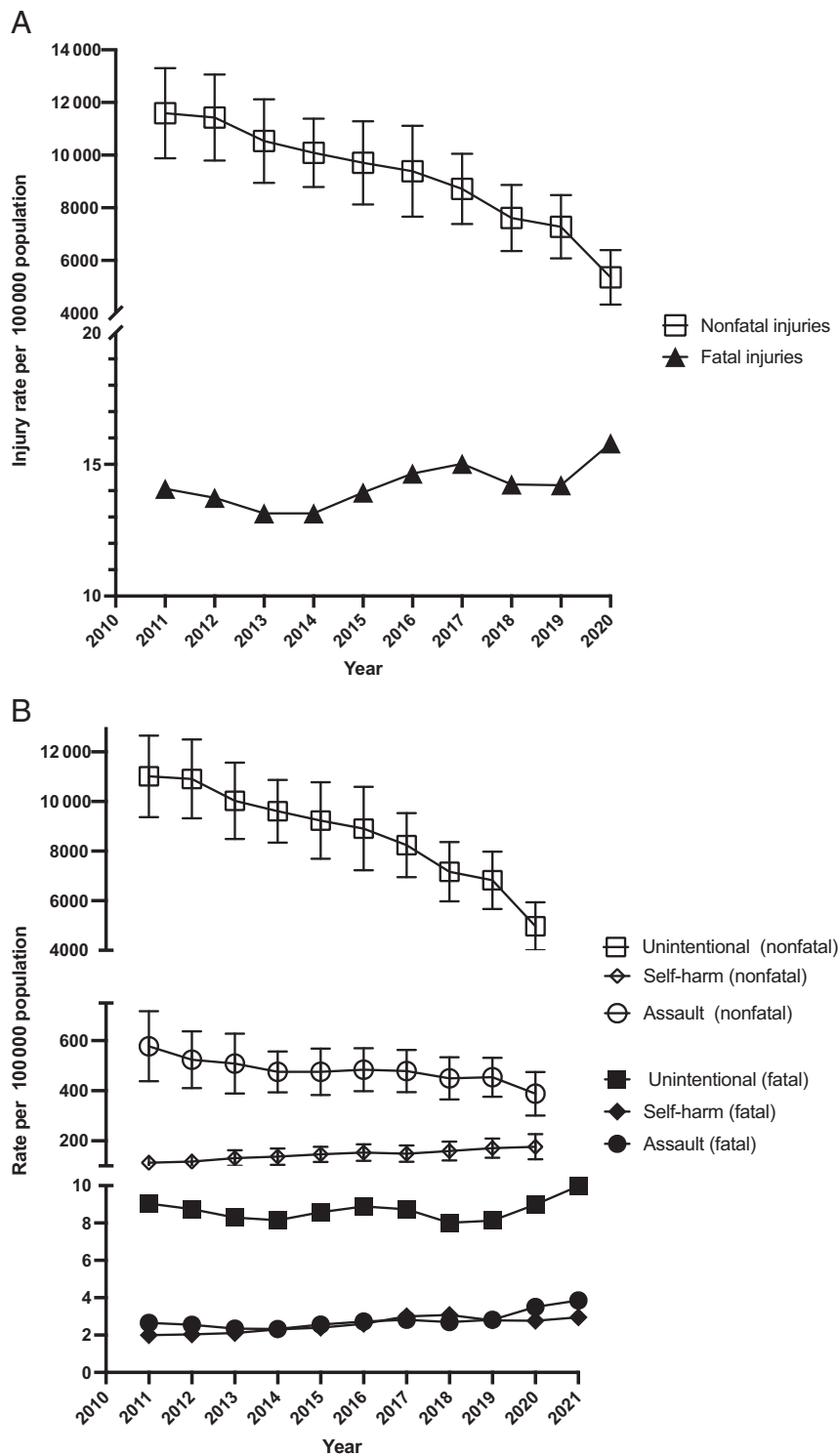
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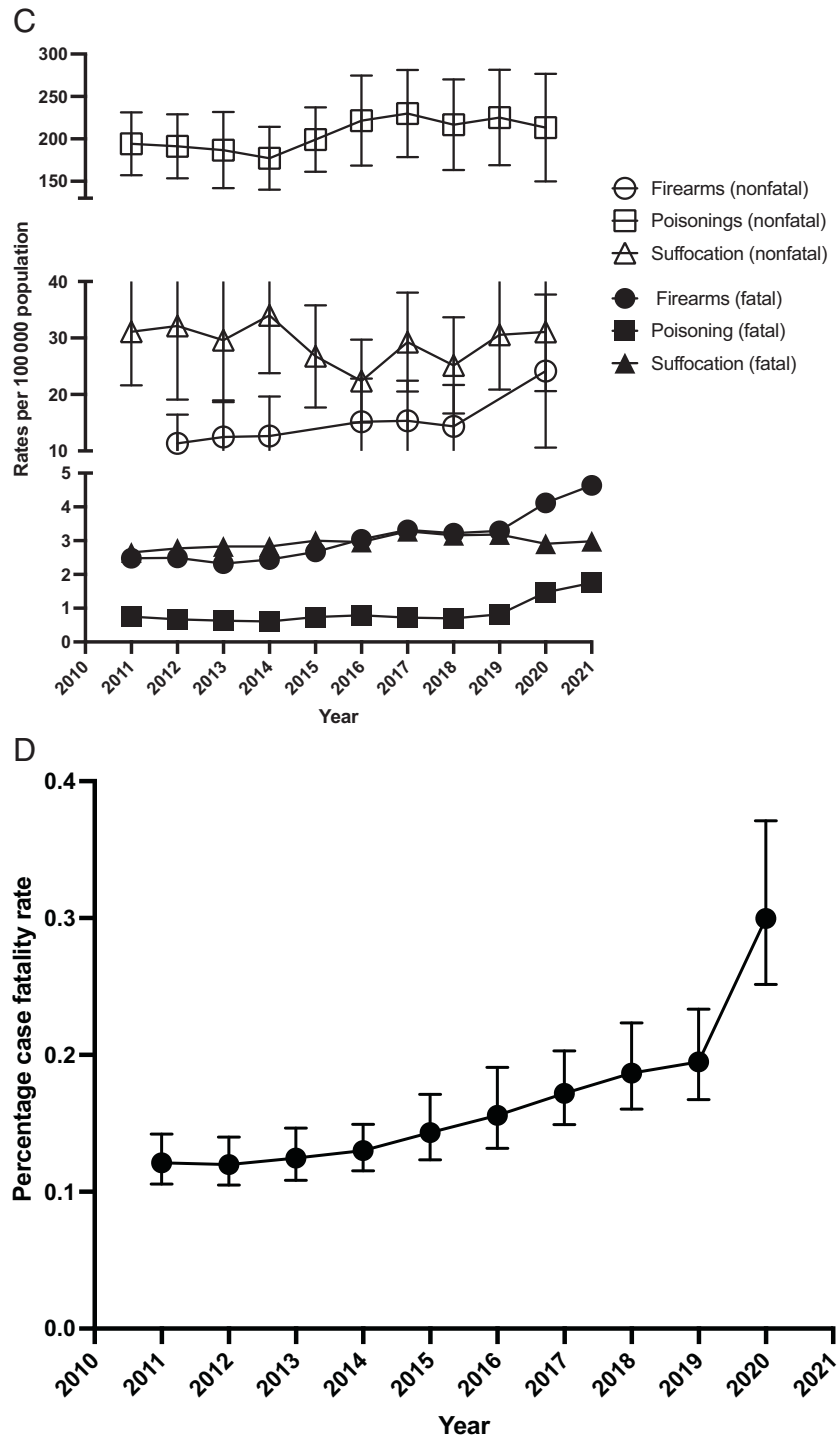
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**FIGURE 1**

1A, Increasing case fatality rate from 2011 to 2020. Nonfatal injuries decreased substantially from 2011 to 2020 ( $P < .0001$  for trend), whereas fatal injuries increased ( $P = .006$ ). Error bars are 95% confidence intervals, based on nonfatal injuries rate estimates in WISQARS. B, Increasing fatal injuries are demonstrated for self-harm ( $P = .0002$ ) and assault ( $P = .0039$ ). Unintentional and assault nonfatal injuries decreased substantially from 2011 to 2020 ( $P < .0001$ ), whereas self-harm nonfatal injuries increased ( $P < .0001$ ) over the same time period. Error bars are 95% confidence intervals, based on nonfatal injuries rate estimates in WISQARS. C, Increasing trends in fatal injuries occurred for suffocation/hanging ( $P = .0252$ ), poisonings ( $P = .0121$ ), and firearms ( $P < .0001$ ). Nonfatal injuries for those same mechanisms showed increases in poisonings ( $P = .0126$ ) and firearms ( $P = .0150$ ), but not suffocation/hanging ( $P = .4445$ ). Error bars are 95% confidence intervals, based on nonfatal injuries rate estimates in WISQARS. D, Case fatality rates increased from 0.12% in 2011 to 0.30% in 2020 ( $P < .0001$  for trend). E, Case fatality rates across mechanisms.



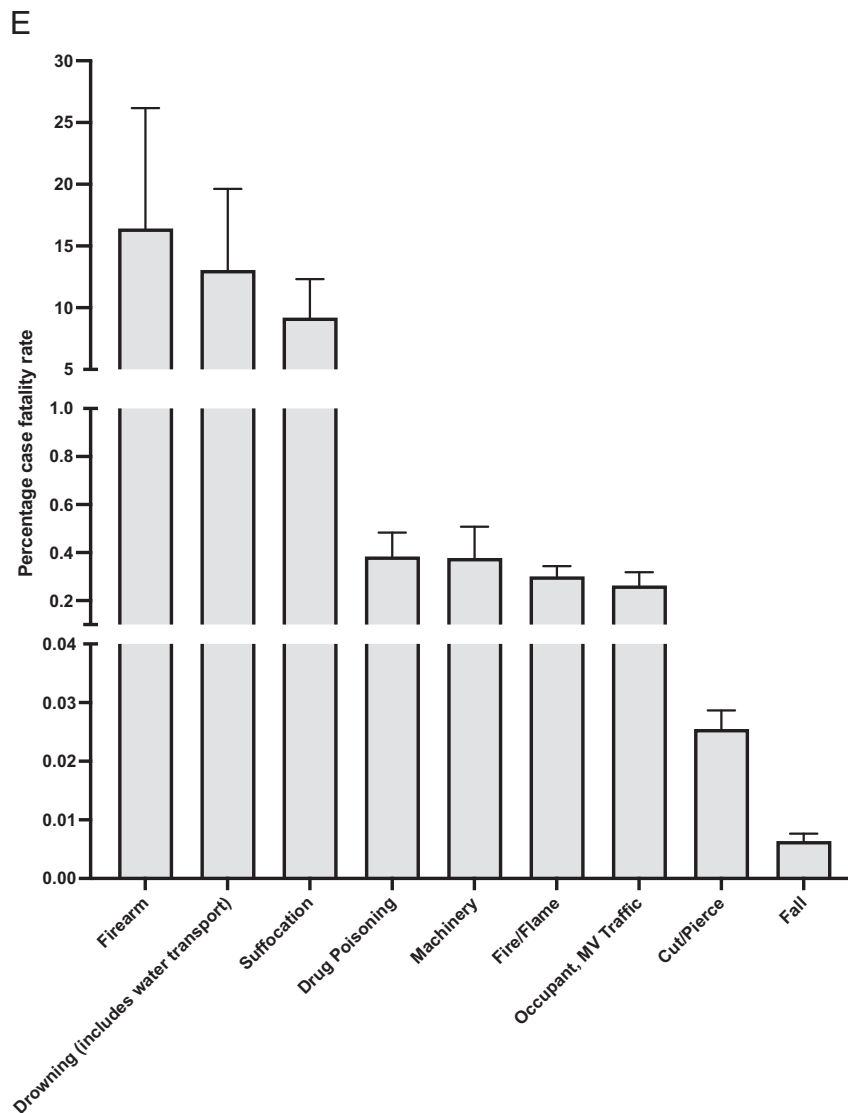
**FIGURE 1**  
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injuries from drowning did not change ( $P = .715$ ) and non-fatal firearm- and poisoning-related injuries increased (113.1%,  $P = .015$  and 9.9%,  $P = .013$ , respectively) (Fig 1C). From 2011 to 2020, the overall case fatality rate increased by 250%

( $P = .0012$ ) (Fig 1D), with the highest case fatality rates in firearm, drowning, and suffocation (Fig 1E).

**DISCUSSION**

Over the past decade, we observed dramatic increases in pediatric case fatality rates, driven both by declining nonfatal



**FIGURE 1**  
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injuries and increasing fatal injuries. The divergent trends between fatal and nonfatal injuries highlight the need for a comprehensive approach to childhood injury prevention. Notably, pediatric injury fatalities sharply increased in the pandemic years of 2020 to 2021, and it remains unclear whether these trends will continue. In contrast, nonfatal injuries showed a steady declining trend throughout the study period, driven largely by decreases in falls (3564 per 100 000 in 2011 vs 1682 per 100 000 in 2020) and struck by/against (2945 per 100 000 in 2011 vs 1088 per 100 000 in 2020) mechanisms. The decrease in nonfatal injuries may also be driven, in part, by recent public health interventions targeting pediatric safety partnered with technological advancements and legislative

requirements. For example, improved booster seat technology has been paired with effective legislative and education campaigns.<sup>4</sup> Yet, despite the progress in reducing most nonfatal injuries, the trends in increasing nonfatal firearm and poisoning injuries defy the overall trend in nonfatal injuries, in part because public health legislative support has lagged in these critical injury mechanisms. This is especially concerning given the high case fatality rate of these injury mechanisms in children. Targeted interventions, such as strengthening legislation, enhancing public awareness, and improving health care systems are needed to address both fatal and nonfatal injuries among children, but these efforts alone are likely not sufficient, given the myriad societal forces that impact pediatric

injuries. Continued research and surveillance are crucial to monitor trends, evaluate interventions, and inform evidence-based strategies for effective injury prevention and mitigation.

#### **ABBREVIATION**

WISQARS: Web-based injury statistics query and reporting system

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