HHS Public Access

Author manuscript

J Emerg Med. Author manuscript; available in PMC 2024 August 01.

Published in final edited form as:

J Emerg Med. 2024 August ; 67(2): e138–e145. doi:10.1016/j.jemermed.2024.03.015.

Nonfatal Emergency Department Visits Associated with Fall-Related Fractured Skulls of Infants Aged 0–4 Months

Juliet Haarbauer-Krupa, PhD, FACRM[*], **Tadesse Haileyesus, MS**[*], **Alexis B. Peterson, PHD**[*], **Lindsay S. Womack, PHD, MPH**[*,†], **Kent Hymel, MD**[‡], **Marzieh Hajiaghamemar, PHD**[§], **Joanne Klevens, MD, PHD**[‖], **Daniel Lindberg, MD**[¶], **Susan S. Margulies, PHD**[#]

[*]Division of Injury Prevention, National Center for Injury Prevention and Control, Centers for Disease Control and Prevention, Atlanta, Georgia

[†]U.S. Public Health Service, Rockville, Maryland

[‡]Department of Pediatrics, Penn State Health Children's Hospital, Hershey, Pennsylvania

[§]Department of Biomedical Engineering, University of Texas at San Antonio, San Antonio, Texas

[‖]Division of Violence Prevention, National Center for Injury Prevention and Control, Centers for Disease Control and Prevention, Atlanta, Georgia

[¶]Department of Emergency Medicine, University of Colorado Medical School, Aurora, Colorado

[#]Wallace H. Coulter Department of Biomedical Engineering, Georgia Institute of Technology and Emory University, Atlanta, Georgia

Abstract

Background: Children aged 0–4 years have the highest rate of emergency department (ED) visits for traumatic brain injury (TBI); falls are the leading cause. Infants younger than 2 years are more likely to sustain a fractured skull after a fall.

Objective: This study examined caregiver actions and products associated with ED visits for fall-related fractured skulls in infants aged 0–4 months.

Methods: Data were analyzed from the 2001–2017 National Electronic Injury Surveillance System-All Injury Program. Case narratives of infants aged 0–4 months who visited an ED for

Reprint Address: Juliet Haarbauer-Krupa, PhD, Division of Injury Prevention, National Center for Injury Prevention and Control, Centers for Disease Control and Prevention, 4700 Buford Highway, MS S106-9, Atlanta, GA 30341.

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

Declaration of competing interest

None.

CRediT authorship contribution statement

Juliet Haarbauer-Krupa: Conceptualization, Investigation, Methodology, Project administration, Supervision, Writing – original draft, Writing – review & editing. **Tadesse Haileyesus:** Conceptualization, Data curation, Formal analysis, Methodology, Writing – original draft. **Alexis B. Peterson:** Conceptualization, Formal analysis, Methodology, Validation, Writing – original draft, Writing – review & editing. **Lindsay S. Womack:** Conceptualization, Formal analysis, Methodology, Validation, Writing – original draft, Writing – review & editing. **Kent Hymel:** Conceptualization, Methodology, Resources, Writing – review & editing. **Marzieh Hajiaghamemar:** Conceptualization, Methodology, Resources, Validation, Writing – review & editing. **Joanne Klevens:** Conceptualization, Methodology, Resources, Writing – review & editing. **Daniel Lindberg:** Conceptualization, Methodology, Writing – review & editing. **Susan S. Margulies:** Conceptualization, Methodology, Resources, Writing – review & editing.

a fall-related skull fracture were examined to code caregiver actions preceding the fall. Product codes determined fall location and product type involved (e.g., flooring, bed, or stairs). All national estimates were weighted.

Results: There were more than 27,000 ED visits (weighted estimate) of infants aged 0–4 months for a nonfatal fall-related fractured skull between 2001 and 2017. Most were younger than 2 months (46.7%) and male (54.4%). Falls occurred primarily in the home (69.9%) and required hospitalization (76.4%). Primary caregiver actions coded involved placing (58.6%), dropping (22.7%), and carrying an infant (16.6%). Floor surfaces were the most common product (mentioned in 24.0% of the cases).

Conclusions: Fall-related fractured skulls are a health and developmental concern for infants, highlighting the importance of a comprehensive assessment at the time of the injury to better understand adult actions. Findings indicated the need to develop prevention messages that include safe carrying and placement of infants. Published by Elsevier Inc.

Keywords

Infants; Traumatic brain injury; Fractured skulls; Adult actions; Prevention

Introduction

Young children aged 0–4 years have the most emergency department (ED) visits for traumatic brain injury (TBI) among all pediatric age groups; falls are the leading cause of injury (1). Infants are more likely than other age groups to sustain a fractured skull injury after a fall due to their lower structural rigidity and presence of sutures (2-4). Although falls may be the initial parent explanation for the ED visit, that report may not always be accurate (5). Examining the circumstances of these head injuries, especially in infants and young children who are unable to provide a report of what happened, is important (6,7). A previous study that examined fall-related TBI ED visits in young children (aged 0–4 years) and the actions associated with the falls, found that most were 1 year or younger (59.7%) and were treated and released from the ED (93%) (5). Most children were classified as having had an internal injury to the head (87.7%) or concussion (9.6%); however, a small percentage of children were diagnosed with a fractured skull (2.7%), potentially indicating a more severe injury. Among children between the ages of 0 and 4 years, the circumstances leading up to the fall were most often associated with actions of the child (87.5%), for example, running, jumping, and tripping. Only 12.5% were caused by the actions of others. However, actions by others were the leading cause of fall-related TBI ED visits (59.7%) for children younger than 1 year. Most of the injuries in the age group from 0 to 4 years occurred in the home. The data source used for this study did not allow for examining fall biomechanics, such as fall height, or clinical features, such as additional injuries, as contributors to injury severity (8).

Head injuries in young infants (aged 0–4 months) are likely related to actions by others because infants at this age are in a developmental stage of motor development with limited self-movement. Clinical diagnosis of intentional and unintentional head injuries is influenced by several factors that include presence of a skull fracture, age, mechanism

of injury, presence of seizures, retinal hemorrhage, and other fractures, such as ribs and long bone fractures (9-13). The presence of skull fractures in young infants is one of the most common diagnoses of abusive head trauma (AHT) in children younger than 3 years and can be a predictor of an intentional injury that requires further examination at the time of evaluation (10, 11, 13). Although falls are the most common injury mechanism reported for young children who report to the ED, the circumstances around the fall are not always reported (1,8). Recent research indicated that when no mechanism of injury is reported by the caregiver, there is an association with AHT (10). Therefore, understanding the circumstances of fall-related fractured skulls can offer insights into why such actions may contribute to injuries in this age group.

The biomechanics of injury-related severity and complexity in young children is related to fall height and surface of impact (2,3,4,14). In a recent study that evaluated stress indicators in witnessed infant falls, findings indicated a lower probability of a fractured skull in infants from a 0.3-m distance, particularly when a carpeted surface was involved and a higher probability of a fractured skull in infants from a 0.9-m distance fall for concrete impact (86–100%) (4). This study highlights the importance of biomechanical parameters to predict skull fracture in infants. In a study examining head kinematics during shaking associated with AHT in animal models, peak accelerations occurred when the animal's head hit the torso and produced high-acceleration magnitudes (15). These studies highlight the importance of biomechanical parameters, fall heights, and type of impact surfaces or floorings to predict the probability of skull fracture occurrence in infants and illustrate the importance of understanding the circumstances surrounding the injury when an infant is receiving a medical evaluation.

The purpose of this study was to examine adult actions and products associated with infant falls among a large nationally representative sample. Better insight into circumstances and actions related to these injuries could aid in preventing future fall-related fractured skulls among infants. Findings can also inform health care providers about what to examine when evaluating infants in this age group and can focus communication on prevention efforts. It can also provide insight into whether the injury was unintentional or intentional. The purpose of this study was to examine actions and products associated with nonfatal ED visits for unintentional fall-related fractured skulls among infants aged 0–4 months.

Materials and Methods

Data Source

Data were acquired from the 2001–2017 National Electronic Injury Surveillance System–All Injury Program (NEISS-AIP), which is a nationally representative stratified probability sample of 66 hospitals with at least six beds that provide 24-h emergency services in the United States. NEISS-AIP is a collaborative effort between the Centers for Disease Control and Prevention (CDC) and the U.S. Consumer Product Safety Commission (CPSC). Data are collected daily from each participating hospital, resulting in the capture of approximately 500,000 nonfatal injury–related ED visits annually. Data variables include age, sex, race and ethnicity, date of injury, body part affected, diagnosis, disposition at discharge, location of injury event, cause and intent of injury, product involved in the injury, and a brief narrative.

NEISS-AIP defines a nonfatal injury as bodily harm resulting from exposure to an external force or substance (i.e., mechanical, thermal, electrical, chemical, or radiant) or submersion. NEISS-AIP has been described elsewhere in more detail and has been used previously to study TBI at the national level (14, 16-19).

Study Population and Study Measures

The sample for this study was drawn from ED visits and included infants aged 0–4 months who were treated for a fall-related fractured skull between 2001 and 2017 (n = 1088), with data extracted from a previous study on fall-related TBI in children aged 0–4 years (8). This age group (0–4 months) was examined based on coauthor agreement about their stage of development. In the original study, fall-related fractured skull cases were defined with "head" as the primary body part affected, "fractured skull" as the diagnosis, "fall" as the primary mechanism of injury, and were coded as "unintentional." NEISS-AIP data include several possible case dispositions at discharge (e.g., treated and released, transferred, hospitalized, left, and unknown) (8). NEISS abstractors assign product codes from a listing of hundreds of products involved in injuries, listing up to two products in no particular order. Although both products lines were examined after data abstraction for the current sample, product one was used in this study due to limited data in the second product listing. Product codes for the top nine products listed (e.g., floors, beds, stairs, and baby products) related to the top caregiver actions were included in this analysis and described in the Results.

For each visit captured by NEISS-AIP data, a trained hospital medical record abstractor created a 140-character narrative based on information extracted from the medical record. These narratives often, but not always, include a brief description of the injury and its cause. The data examined for this study were abstracted from a dataset coded for a previous study in which narratives were searched using *SAS* Index Functions (8). Infants in this age group are just beginning to achieve motor movement and mobility milestones, so the primary focus was on caregiver actions that led to the fall. Two trained researchers independently reviewed all case narratives to identify caregiver actions associated with the fall. For this study, a coding manual was created with agreed-upon definitions prior to review: caregiver actions were coded as "Carry (caregiver carried child)," "Place (caregiver placed child on a surface)," "Drop (caregiver dropped child)," "Push/Pull (child was pushed or pulled by another person or caregiver)," "Throw/Flung (child was thrown or flung by a caregiver)," "Fall/Fell (caregiver fell while holding or carrying the child)," and "Not Enough Information (not enough information was included in the narrative to determine a specific action)." For example, if the narrative read, "child rolled off the table," we assumed that the infant was placed on the table by a caregiver and this action was coded as "Place." For each narrative, the researchers provided a code describing the action that initiated the fall.

To train for case narrative coding, two researchers initially coded the same 10 cases (initial agreement = 85%) and discussed any discrepancies to achieve 100% agreement. The researchers applied lessons learned from coding the previous 10 cases and coded the remaining narratives (n = 1088) with 100% agreement. The first author (J.H.K) verified final coding. Finally, we examined the product codes associated with the most common caregiver actions.

Study Design and Statistical Analysis

This was a descriptive study designed to examine and describe actions and products associated with nonfatal ED visits for unintentional fall-related fractured skulls among infants. Frequencies, percentages, and 95% confidence intervals (CIs) were computed to obtain demographic and injury characteristics. Weighted estimates were calculated using sample weights from the CPSC based on the probability of selection of each hospital and the annual number of ED visits over time. The 95% CIs were calculated using a direct variance estimation procedure that accounted for the sample weights and complex sample design (16). Analyses were conducted using *SAS* software, version 9.4 (SAS Institute, Inc.). Some estimates are not shown because they were deemed unstable (i.e., if < 20 cases [unweighted data], the national estimates were < 1200 [weighted data], or the estimate's coefficient of variation was > 30%).

Results

Fall-related Fractured Skulls by Infant and Injury Characteristics

Between 2001 and 2017, there were an estimated 27,398 ED visits in the United States of infants aged 0–4 months treated for nonfatal fall–related fractured skulls (Table 1). One-half of the ED visits for infants who sustained injuries were for male patients (54.4%; 95% CI 36.0–72.8%) younger than 2 months (46.7%; 95% CI 30.4–63.0%). Most infants who visited the ED with fall-related fractured skulls were hospitalized or transferred (76.4%; 95% CI 46.3–100.0%), and a smaller percentage of those were treated and released from the ED (19.7%; 95% CI, 12.4–27.1%). Among all years in the study period, 44.1% (95% CI 28.0–60.2%) of fall-related fractured skulls occurred between 2012 and 2017. We could not calculate 95% CIs for race and ethnicity and location because many cases were listed as unknown. Almost 70% (69.9%) of fractured skull injuries that did have recorded location were reported in the home (n = 711).

Fall-Related Fractured Skulls by Action Type

Caregiver actions associated with fall-related fractured skulls are listed in Table 2. Most of the caregiver actions were "Place" (58.6%; 95% CI 39.4–77.8%), followed by "Drop" (22.7%; 95% CI 14.4–30.9%) and "Carry" (16.6%; 95% CI 9.1–24.1%). "Place" indicates that a caregiver placed a child in a specific location; whereas "Drop" and "Carry" were indicated by the words in the text. Caregiver actions, such as "Push/Pull/Throw," were among the top four actions identified, but these estimates were unstable.

Fall-Related Fractured Skulls by Products

The top products involved with fractured skulls in infants aged 0–4 months are listed in Table 3. Floors were the leading product category contributing to fall-related fractured skulls (24.0%; 95% CI 14.3–33.6%). Beds were the second leading product category (14.8%; 95% CI 7.7–21.9%), followed by stairs (9.6%; 95% CI 4.7–14.4%), car seats for infants and children (9.2%; 95% CI 4.8–13.6%), and sofas (5.0%; 95% CI 2.5–7.5%). The large category of "All other products" associated with caregiver actions (20.2%) indicates various products, but none were largely involved with the injury (e.g., fall in bathtub or fall from

motor vehicle when removing car seat), resulting in unstable estimates that are not reported. Post-hoc analyses (data not shown) revealed that the products associated with caregiver action of “Place” included beds or bedframes (23.4%; 95% CI 12.4–34.5%), followed by floors or flooring materials (18.1%; 95% CI 8.7–27.6%) and car seats for infants or children (11.2%; 95% CI 6.6–15.8%). The top product associated with the caregiver action of “Drop” was floors or flooring material (data not shown; 46.8%; 95% CI 26.9–66.6%). Other products frequently associated with specific caregiver actions were unstable and not reported.

Discussion

This study examined a nationally representative database between 2001 and 2017 to better understand caregiver actions and products related to fall-related fractured skulls in infants aged 0–4 months, an age when they are beginning to gain ability to move in their environment. Findings indicate that most injuries occurred in the home and that most infants with fractured skulls were hospitalized. The primary actions leading to these falls were placing an infant on a surface, followed by dropping and then carrying an infant. Floor surfaces were the leading product related to the fall. This study aligns with findings from a previous study that reported actions by others were the primary cause of TBI-related falls, resulting in an ED visit for children younger than 1 year (8). When young infants present to the health care setting for care with a TBI, clinical screening and a comprehensive examination that includes an understanding of the biomechanics of the injury (i.e., fall height and impact surface) can also provide insight into the circumstances of fall-related skull fractures in infants, safe practices, and fall prevention education.

As we learned from our results, most injuries occurred in the home, a common location of injuries for young children, as noted in other studies (8,20,21). In the home environment, care supervision practices, such as attention, proximity and continuity, and environmental hazards are key determinants of injury risk (1). Parents may lack experience caring for a new baby when first bringing their baby home from the hospital after birth, and lack sleep due to the nature of newborn behavior, which could influence their decisions about where to place or how to carry the infant. However, parent status related to falls (i.e., fatigue) was not indicated in this dataset. A newborn safety bundle, combined with education, is a prevention method that involves wrapping the infant in a sleep sack bundle. It is designed to promote safe sleep and to minimize fall risk and is initiated in the hospital setting. This can be an important first step in parent education about safe sleep and attending to the infant (22). Home safety interventions are most commonly provided as one-to-one, face-to-face education and are effective in increasing many safety practices (21,23,24). Evidence shows that such interventions may reduce injury rates, particularly those provided at home (24). Future studies might examine the content of injury prevention messages provided by pediatricians related to infant fall prevention, through both verbal and written instruction during well-check visits. Furthermore, examining the degree of universality of these messages and how often they are repeated across visits may be beneficial.

Falls are frequently a reason young children visit the ED, and although this may be the initial parent explanation for the visit, as indicated in previous studies, their description may

not always be complete or accurate (5-7,25-27). Recent research also reports that when no mechanism of injury is reported by the caregiver, there is an association with AHT (10). Based on our examination of caregiver actions, a fall in this young age group warrants further examination of the infant and circumstances of the fall. Although our study focused on unintentional injuries, a fractured skull in this group (where independent mobility is extremely limited) is one of the most common signs of AHT, and child physical abuse is also a mechanism that can cause a fractured skull (5,6, 10,11,24-27). Clinical tools for health care providers, such as PredAHT (Predicting Abusive Head Trauma) can identify AHT symptoms at the time of the health care visit, which can influence a clinician's probability estimates of the trauma in children younger than 3 years who present with intracranial injuries (28,29). Further examining children helps to determine health history, presence of seizures, retinal hemorrhage, and other orthopedic injuries (9-13).

Injury severity and complexity in young children is related to fall height and surface of impact (2-5,25). Although the current study could not identify fall height in the narratives, findings reported from the biomechanics literature offer insight and can inform a more comprehensive assessment for circumstances related to the fall for medical providers. When examining the biomechanics of children's falls, research supports that even "short falls" (often defined as <5 ft) may be used as explanations for unintentional injuries that are in reality AHT (7,10).

A recent study found that infants were most likely to fall onto floors, which may also contribute to the likelihood of a skull fracture (4). Infants falling from a 0.3-m distance were less likely to sustain a fractured skull, particularly when the fall occurred on a carpeted surface (4). Studies on the biomechanical aspects of falls illustrate the importance of understanding the circumstances surrounding the injury, including fall height, additional injuries, and type of impact surface when an infant is receiving a medical evaluation (27).

Limitations

Findings from this study are subject to at least five limitations. First, NEISS-AIP includes nonfatal injuries treated in hospital EDs only, and not those seen in physician offices or outpatient clinics, which can be an undercount of injuries and may only capture more severe injuries. It also does not include fatal fall-related skull fractures. Second, the narrative descriptions provided in NEISS-AIP are captured from health care providers' notes of caregiver statements, which may result in reporting inaccuracies. Third, NEISS-AIP data do not provide consistent information on the individuals who completed the action related to the fall (such as whether it was an adult or another child) or detailed sociodemographic information, which limits analysis of sociodemographic factors and family structure. Fourth, due to many unknowns, 95% CIs around estimates stratified by race and ethnicity and fall location were not computed. Lastly, de-spite removing cases that were deemed intentional, some of the cases examined may have been AHT-related, due to the challenges of accurately ascertaining intentionality in the health care setting.

Conclusions

Because of their risk of abusive head trauma, health care professionals examining the infant at the time of injury need to conduct a comprehensive assessment at the time of injury that includes a better understanding of injury circumstances. Pediatric health care professionals in contact with caregivers of young children can provide education about the importance of care supervision practices that promote safety when carrying and placing an infant in the home.

When parents leave the hospital after childbirth, education about attending to and placing infants in a safe space, such as their crib, and how to safely carry an infant to prevent dropping could prevent infant falls. Pediatricians can also educate parents about fall prevention during well visits for young infants. Although there is some information available for parent education, how universal and frequently these messages are communicated and if they are effective for prevention is unclear. There is a lack of evidence-based fall prevention strategies for infants. The fall prevention methods pediatricians and other health care specialists currently discuss with new parents are not well understood and require further investigation to ascertain what information is provided to new parents and caregivers (22,24,30,31).

Acknowledgments

The authors appreciate Dr. Rachel P. Berger's review and the support from the Georgia Research Alliance (S.S.M.).

References

1. Centers for Disease Control and Prevention. Surveillance Report of Traumatic Brain Injury-related Emergency Department Visits, Hospitalizations, and Deaths—United States, 2014. Centers for Disease Control and Prevention, US Department of Health and Human Services; 2019.
2. Ibrahim NG, Margulies SS. Biomechanics of the toddler head during low-height falls: anthropomorphic dummy analysis. J Neurosurg Pediatr 2010;6:57–8. [PubMed: 20593989]
3. Ibrahim NG, Wood J, Margulies SS, Christian CW. Influence of age and fall type on head injuries in infants and toddlers. Int J Dev Neurosci 2012;30:201–6. [PubMed: 22079853]
4. Hajiaghamemar M, Lan IS, Christian CW, Coats B, Margulies SS. Infant skull fracture risk for low height falls. Int J Legal Med 2019;133:847–62. [PubMed: 30194647]
5. Amagasa S, Matsui H, Tsuji S, et al. Accuracy of the history of injury obtained by caregivers in infantile head trauma. Am J Emerg Med 2016;34:1863–7. [PubMed: 27422215]
6. Hettler J, Greenes DS. Can the initial history predict whether a child with head injury has been abused? Pediatrics 2003;111:602–7. [PubMed: 12612243]
7. Narang SK, Fingarson AM, Lukefahr JCouncil on Child Abuse and Neglect. Abusive head trauma in infants and children. Pediatrics 2020;145(4). doi:10.1542/peds.2020-0203.
8. Haarbauer-Krupa J, Haileyesus T, Gilchrist J, Mack KA, Law CS, Joseph A. Fall-related traumatic brain injury in children ages 0-4 years. J Saf Res 2019;70:127–33.
9. Berger RP, Parks S, Fromkin J, Rubin P, Pecora P. Assessing the accuracy of the International Classification of Diseases Codes to identify abusive head trauma: a feasibility study. Inj Prev 2015;21:e133–7. doi:10.1136/injuryprev-2013-040924. [PubMed: 24167034]
10. Burns J, Rohl S, Marth D, Proctor D, Amin R, Sekhon C. Which clinical features of children on initial presentation to the emergency department with head injury are associated with clinically important traumatic brain injury, classification as abuse and poor prognosis. Pediatr Emerg Care 2022;38(1):e254–8. doi:10.1097/PEC.0000000000002239. [PubMed: 32925700]

11. Chahla S, Ortega H. Intracranial injury among children with abuse-related long bone fractures. J Emerg Med 2020;59: 735–743. [PubMed: 32682640]
12. Henry MK, Feudtner C, Fortin K, et al. Occult head injuries in infants evaluated for physical abuse. Child Abuse Negl 2020;103. doi:10.1016/j.chiabu.2020.104431.
13. Hymel KP, Armijo-Garcia V, Foster R, Frazer TN, Stoiko M, Christie LMPediatric Brain Injury Research Network. Validation of a clinical prediction rule for pediatric abusive head trauma. Pediatrics 2014;134(6):e1537–44. doi:10.1542/peds.2014-1329. [PubMed: 25404722]
14. Quinlan K, Thompson M, Annest J. Expanding the National Electronic Injury Surveillance System to monitor all nonfatal injuries treated in U.S. hospital emergency departments. Ann Emerg Med 1999;34:637–45. [PubMed: 10533012]
15. Lintern TO, Puhulwelle G, Bloomfield FH, Kelly P, Finch MC. Head kinematics during shaking associated with abusive head trauma. J Biomech 2015;48:3123–7. [PubMed: 26256822]
16. Schroeder T, Ault K. NEISS All Injury Program: Sample Design and Implementation. U.S: Consumer Product Safety Commission; 2001.
17. Cheng TA, Bell JM, Haileyesus T, Gilchrist J, Sugarman DE, Coronado VG. Nonfatal playground-related traumatic brain injuries among children, 2001-2013. Pediatrics 2016;117(6):1–9.
18. Coronado VG, Haileyesus T, Cheng TA, et al. Trends in sports- and recreation-related traumatic brain injuries treated in US emergency departments: The National Electronic Injury Surveillance System-All Injury Program (NEISS-AIP) 2001-2012. J Head Trauma Rehab 2015;30:185–97.
19. Sarmiento K, Thomas KE, Daugherty J, et al. Emergency department visits for sports- and recreation-related traumatic brain injuries among children—United States, 2010–2016. MMWR Morb Mortal Wkly Rep 2019;68:237–42.
20. Saluja G, Brenner R, Morrongiello BA, Haynie D, Rivera M, Cheng TL. The role of supervision in child injury risk: definition, conceptual and measurement issues. Inj Control Saf Promot 2004;11:17–22. [PubMed: 14977501]
21. Morrongiello BA, Schwebel DC. Introduction to special section: pediatric psychology and child unintentional injury prevention: current state and future directions. J Pediatr Psychol 2017;42:721–6. [PubMed: 29017239]
22. Lipke B, Gilbert G, Shimer H, et al. Newborn safety bundle to prevent falls and promote safe sleep. MCN Am J Matern Child Nurs 2018;43(10):32–7. [PubMed: 29045245]
23. Dawson P, Van Dooenininck WJ, Robinson JL. Effects of home based, informal social support on child health. Dev Behav Pediatr 1989;10(2):63–7.
24. Morrongiello BA, Hou S, Bell M, Walton K, Filion AJ, Haines J. Supervising for Home Safety Program: a randomized controlled trial (RCT) testing community-based group delivery. J Pediatr Psychol 2017;42:768–78. [PubMed: 27771617]
25. Apfeld JC, Crichton KG, Minneci PC, Puls HT, Cooper JN. Identification of physical abuse in young children: impact of the transition to ICD-10-CM related coding. Child Abuse Negl 2021;118. doi:10.1016/j.chiabu.2021.105159.
26. Zins ZP, Wheeler KK, Brink F, et al. Trends in US physician diagnosis of child physical abuse and neglect injuries, 2006-2014. Child Abuse Negl 2019;98. doi:10.1016/j.chiabu.2019.104179.
27. Chadwick DL, Bertocci G, Castillo E, et al. Annual risk of death resulting from short falls among young children: less than 1 in 1 million. Pediatrics 2008;121:1213–24. [PubMed: 18519492]
28. Cowley LE, Farewell DM, Kemp A. Potential impact of the validated Predicting Abusive Head Trauma (PreAHT) clinical prediction tool: a clinical vignette study. Child Abuse Negl 2018;86:184–96. [PubMed: 30312886]
29. Cowley LE, Morris CB, Maguie SA, Farewell DM, Kemp AM. Validation of a prediction tool for abusive head trauma. Pediatrics 2015;136:290–8. [PubMed: 26216332]
30. Benford P, Young B, Coupland C, Watson M, Hindmarch P, Hayes MKeeping Children Safe Study Group. Risk and protective factors for falls on one level in young children: multi-centre case—control study. Inj Prev 2015;21:381–8. [PubMed: 26271259]
31. Morrongiello BA, Corbett M, McCourt M, Johnson N. Understanding unintentional injury-risk in young children I. The nature and scope of caregiver supervision of children at home. J Pediatr Psychol 2006;31:529–39. [PubMed: 16034003]

Table 1.

Nonfatal emergency department visits for unintentional fall-related fractured skulls among children aged 0–4 months treated in the United States by selected characteristics, 2001–2017.

Characteristics	Sample cases	National estimate	Percent	95% confidence interval
Total	**1,088**	**27,398**	**100.0**	
Sex				
Male	608	14,893	54.4	36.0 - 72.8
Female	479	12,482	45.6	29.9 - 61.2
Unknown [a]	1	22	0.1	-
Race/Ethnicity[b]				
Non-Hispanic White	506	14,333	52.3	-
Non-Hispanic Black	134	2,187	8.0	-
Hispanic	87	2,205	8.0	-
Other Non-Hispanic	44	751	2.7	-
Unknown	317	7,922	28.9	-
Age (months)				
0 to <2 Months	470	12,798	46.7	30.4 - 63.0
2 Months	266	6,560	23.9	13.0 - 34.9
3 Months	197	4,498	16.4	10.8 - 22.1
4 Months	155	3,542	12.9	8.7 - 17.1
Location of Fall[b]				
Home/Apartment/Mobile Home	711	19,157	69.9	-
Street/Public	70	1,649	6.0	-
School	1	10	0.0	-
Sports	10	130	0.5	-
Other/Unknown	296	6,453	23.6	-
Disposition				
Hospitalized/Transferred	696	20,924	76.4	46.3 - 100.0
Treated and Released	306	5,410	19.7	12.4 - 27.1
Other/Unknown [a]	86	1,065	3.9	-
Year Grouped				
2001–2006	246	6,670	24.3	14.9 - 33.8
2007–2011	354	8,639	31.5	17.4 - 45.7
2012–2017	488	12,089	44.1	28.0 - 60.2

[a] 95% confidence interval (CI) is not shown because it is considered unstable due to small sample size and/or CV > 30%.

[b] Due to a high percentage of unknowns, the CI is not reported: https://www.cpsc.gov/Research--Statistics/NEISS-Injury-Data). For more information, visit https://wisqars.cdc.gov/nonfatal-reports.

Table 2.

Nonfatal emergency department visits for unintentional fall-related fractured skulls among children aged 0–4 months treated in United States by caregiver action, 2001–2017.

Rank	Caregiver Action	Weighted estimate	Percent (95% CI*)
1	Place	16,057	58.6 (39.4–77.8)
2	Drop	6,211	22.7 (14.4–30.9)
3	Carry	4,549	16.6 (9.1–24.1)
4	Push/Pull/Throw	581	2.1 (---)
	Total	**27,396***	**100.0**

*Confidence interval (CI) is not shown because it is considered unstable due to small sample size and CV > 30%. Estimates may not sum to the total because of rounding.

Table 3.

Products involved with nonfatal emergency department visits for unintentional fall-related fractured skulls among children aged 0–4 months treated in United States, 2001–2017.

Rank	Product Type	Weighted estimate	Percent (95% CI*)
1	Floors or flooring materials	6,567	24.0 (14.3–33.6)
2	Beds or bedframes	4,046	14.8 (7.7–21.9)
3	Stairs or steps	2,623	9.6 (4.7–14.4)
4	Car seats	2,520	9.2 (4.8–13.6)
5	No product involved	1,994	7.3 (3.8–10.7)
6	Sofas, couches, davenports, divans	1,363	5.0 (2.5–7.5)
7	Baby strollers	1,065	3.9 (---)
8	Tables	914	3.3 (---)
9	Baby bouncer seats (excl. jumpers)	777	2.8 (---)
10	All other products	5,527	20.2 (12.7–27.6)
	Total	**27,396***	**100.0**

*Confidence interval (CI) is not shown because it is considered unstable due to small sample size and/or CV > 30%. Estimates may not sum to the total because of rounding.