Sentinel Injuries in Infants Evaluated for Child Physical Abuse

AUTHORS: Lynn K. Sheets, MD,[a,b] Matthew E. Leach, MD,[c] Ian J. Koszewski, MD,[d] Ashley M. Lessmeier, BS,[a] Melodee Nugent, MA,[a] and Pippa Simpson, PhD[a]

[a]*Medical College of Wisconsin, Milwaukee, Wisconsin;* [b]*Children's Hospital of Wisconsin, Milwaukee, Wisconsin;* [c]*St Louis University School of Medicine, St Louis, Missouri; and* [d]*University of Wisconsin Hospital and Clinics, Madison, Wisconsin*

KEY WORDS

abuse, bruising, infants, maltreatment, screening, abusive head trauma

ABBREVIATIONS

AHT—abusive head trauma
CHW—Children's Hospital of Wisconsin
CPT—Child Protection Team

Dr Sheets conceptualized and designed the study, assisted in data abstraction, drafted the initial article, and approved the final article as submitted. Dr Sheets had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. As second-year medical students at the Medical College of Wisconsin, Drs Leach and Koszewski and Ms Lessmeier performed chart abstraction in the abusive head trauma, non–abusive head trauma definite abuse, and control/intermediate substudies, respectively, entered data into the database, edited the article, and approved the final article as submitted. Ms Nugent and Dr Simpson assisted with study design and power calculations, performed data analysis, wrote the statistical components of the article, edited the article, and approved the final article as submitted.

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Address correspondence to Lynn K. Sheets, MD, Children's Hospital of Wisconsin, Child Advocacy and Protection Services, C615, PO Box 1997, Milwaukee, WI 53201. E-mail: lsheets@chw.org

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WHAT'S KNOWN ON THIS SUBJECT: Although it is known that relatively minor abusive injuries sometimes precede more severe physical abuse, the prevalence of these previous injuries in infants evaluated for abuse was not known.

WHAT THIS STUDY ADDS: A history of bruising or oral injury in a precruising infant evaluated for abuse should heighten the level of suspicion because these injuries are common in abused infants and rare in infants found not to be abused.

abstract

OBJECTIVE: Relatively minor abusive injuries can precede severe physical abuse in infants. Our objective was to determine how often abused infants have a previous history of "sentinel" injuries, compared with infants who were not abused.

METHODS: Case-control, retrospective study of 401, <12-month-old infants evaluated for abuse in a hospital-based setting and found to have definite, intermediate concern for, or no abuse after evaluation by the hospital-based Child Protection Team. A sentinel injury was defined as a previous injury reported in the medical history that was suspicious for abuse because the infant could not cruise, or the explanation was implausible.

RESULTS: Of the 200 definitely abused infants, 27.5% had a previous sentinel injury compared with 8% of the 100 infants with intermediate concern for abuse (odds ratio: 4.4, 95% confidence interval: 2.0–9.6; $P < .001$). None of the 101 nonabused infants (controls) had a previous sentinel injury ($P < .001$). The type of sentinel injury in the definitely abused cohort was bruising (80%), intraoral injury (11%), and other injury (7%). Sentinel injuries occurred in early infancy: 66% at <3 months of age and 95% at or before the age of 7 months. Medical providers were reportedly aware of the sentinel injury in 41.9% of cases.

CONCLUSIONS: Previous sentinel injuries are common in infants with severe physical abuse and rare in infants evaluated for abuse and found to not be abused. Detection of sentinel injuries with appropriate interventions could prevent many cases of abuse. *Pediatrics* 2013;131:701–707

Infancy is a time of high risk for maltreatment.[1] Early detection of subtle injuries from abuse in young infants might identify those who are at risk for suffering more serious abusive injuries.[2–7] Child physical abuse prevention efforts have focused on risk reduction through educational interventions such as home visitation, parenting programs, and coping with infant crying.[8] Given the high social and financial costs of infant physical abuse,[2] prevention efforts such as improved recognition of the earliest signs of physical abuse before the abuse escalates would be beneficial. Relatively minor injuries, such as frenulum tears or bruising in precruising infants (infants unable to pull to a stand and walk while holding onto something), may be the first indication to a caregiver or medical provider of child physical abuse.[3–7] Minor injuries other than superficial abrasions are uncommon in normal, precruising infants[9–11] and, when they occur, should raise a concern for abuse.[10] In an illustrative case from our institution, a 2-month-old infant was admitted to the hospital after suddenly becoming limp and unresponsive at home. He had subdural hemorrhages, extensive retinal hemorrhages, and acute and healing fractures. Ultimately, he was diagnosed with abusive head trauma (AHT). Two weeks before admission, his mother had noticed a bruise on his cheek (Fig 1). If the mother had sought medical attention for the bruise, the subsequent AHT might have been prevented, assuming the medical provider could establish the appropriate diagnosis. Failure to recognize and take action when relatively minor, suspicious injuries occur may have devastating consequences for the infant and family.

Despite the known association between intraoral injuries and bruising in precruising infants with later, more serious abuse,[3–7] it is not known how many infants evaluated for abuse have a previous history of relatively minor, suspicious injuries. We termed these previous injuries sentinel injuries. The purpose of this study was to determine what percentage of definitely abused infants evaluated by a hospital-based Child Protection Team (CPT) had a history of a sentinel injury and compare them to: (1) those infants with intermediate concerns for abuse and (2) those infants evaluated for abuse but found to not be abused, termed "controls."

FIGURE 1
Illustrative example of sentinel injury: a 2-month-old infant with unexplained cheek bruising, likely from abuse.

METHODS

This study was a retrospective, case-control study of 401 infants <12 months of age evaluated by the hospital-based, interdisciplinary CPT at Children's Hospital of Wisconsin (CHW) between March 2001 and October 2011. The study analyzed 4 nonconcurrent cohorts of 100 infants each, in separate substudies (with the exception of 101 control infants). In each substudy, cases were selected for inclusion consecutively from the CPT log of all comprehensive CPT consults. Comprehensive CPT consults at CHW have been performed in a consistent manner for at least the past 10 years and have routinely included a complete medical history, physical examination, and appropriate diagnostic studies. Comprehensive consults were defined as those for which a medical history and physical examination were performed by the CPT pediatrician and a consultation report was produced that provided an opinion about the level of concern for abuse. Controls were infants evaluated for abuse and found to not be abused.

Description of Substudies

The 4 study cohorts, spanning different time frames (Fig 2), were classified by CPT level of concern for abuse: definite abuse by AHT (March 2001–February 2008), definite abuse with non-AHT injuries (includes abusive abdominal trauma, fractures, and burns, July 2002–March 2009), intermediate concern for abuse (July 2006–October 2011), and no concern for abuse (March 2007–February 2011). The cohort with no concern for abuse served as the control. The AHT and non-AHT definite-abuse cohorts consisted of infants with CPT consultation reports containing phrases such as "with reasonable medical certainty" and "diagnostic." For the intermediate concern and control cohorts, the level of suspicion 7-point scale developed by Lindberg et al[12] was used during chart abstraction to categorize infants into cohorts. Infants in the intermediate

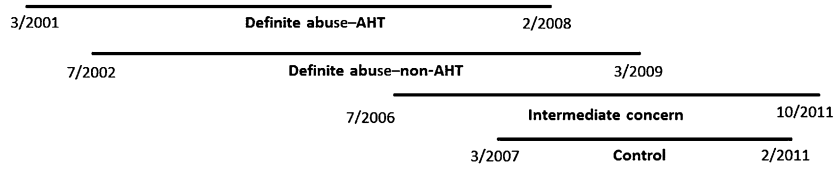

FIGURE 2
Case ascertainment intervals of each substudy. The case ascertainment interval for each of the 4 substudies is demonstrated. Institutional review board (IRB) approval is the last date of each line.

level of concern cohort (levels 3–5) were those whose CPT reports contained phrases such as "concerning but not diagnostic" and "somewhat concerning." The CPT reports for infants in the control cohort (Lindberg levels 1 and 2) contained phrases such as "consistent with history," "explained by underlying condition," and "no concern for abuse." Consensus about the abuse level of certainty ranking by 2 of the authors was required to include a case in each cohort: AHT (L.K.S. and M.E.L.), non-AHT abuse (L.K.S. and I.J.K.), and intermediate-concern and control cohorts (L.K.S. and A.M.L.). Infants were excluded from all cohorts if the CPT consultation was not comprehensive.

Data Abstraction

Basic demographic data for each subject were recorded, including gender, ethnicity (as classified by the subject's parent/guardian), and subject's age at the time of admission. Developmental information regarding mobility at the time of the sentinel injury was noted. The CHW institutional review board approved each of the 4 substudies. The research team reviewed all available records, including all medical records, the primary care physician's records, child protective service reports, and law enforcement reports. Medical records were specifically reviewed for any history of previous injuries such as bruising, intraoral injuries, or other injuries, excluding superficial abrasions. The reported location of previous bruising was categorized as head (forehead, ear, or other areas of the face), extremity, or trunk. Examples of intraoral injury include frenulum injury or contusion of the tongue.

Classification of Injuries

A previous injury was defined as a sentinel injury if it was reported to have been visible to at least 1 parent before the events leading to the current admission and was suspicious for abuse because the child was not able to cruise or there was an implausible explanation offered. Occult injuries, such as healing rib fractures not diagnosed until the CPT consult, were not classified as sentinel injuries because they are not visible. For example, in the illustrative case of the 2-month-old infant with AHT who had a history of a cheek bruise and had healing rib fractures diagnosed at the time of the CPT evaluation, only the bruise seen 2 weeks before admission would be considered a sentinel injury. Details of each previous injury, including the type of injury, who was reportedly aware of the injury, the age of the child at time of injury, the location on the body, the circumstances of the injury, and the time to resolution were recorded when that information was available. Vague recollections of nonspecific marks, such as a "red mark" after bumping the head, were not included. When there was a history that a medical provider knew about an injury, we attempted to ascertain whether the provider suspected abuse and what action was taken.

Statistical Analysis

Percentages of sentinel injuries in the 4 cohorts were compared; odds ratios and 95% confidence intervals were calculated when feasible. Because some percentages were 0, odds ratios could not be calculated. χ^2 Tests were performed for categorical variables. Owing to nonnormality of continuous variables, the nonparametric Mann–Whitney test was performed. The cutoff level for significance was set at $P = .05$. Statistical analyses were performed by using SPSS version 20 (IBM SPSS Statistics, IBM Corporation, Armonk, NY). There were no missing patients in each consecutive series.

RESULTS

Across the 4 cohorts, subjects did not differ with respect to gender ($P = .76$) or age ($P = .06$) (Table 1). Of the 401 subjects, male infants (63%) outnumbered female infants (37%). There were more African-American infants and fewer infants classified as Hispanic/other in the non-AHT definite abuse cohort than in the other 3 cohorts ($P \leq .001$). There were 15 deaths in the AHT cohort, none in the definitely abused, non-AHT cohort, 1 nonabusive death in the intermediate concern cohort, and 2 natural deaths in the control cohort ($P \leq .001$).

There were 63 infants with a history of sentinel injury: 30 of 100 (30%) in the AHT cohort, 25 of 100 (25%) in the non-AHT abuse cohort, 8 of 100 (8%) in the intermediate-concern cohort, and 0 of 101 in the control cohort (Fig 3). Of the 200 infants who were definitely abused (combined AHT and non-AHT cohorts), 55 (27.5%) had a sentinel injury. Of those, 80% had a bruise, 11% had an intraoral injury, and 7% had a fracture. Some definitely abused infants had >1 sentinel injury either within 1 reported episode or during different episodes. In the 55 definitely abused infants with sentinel bruising, there were 66 sentinel bruises in various locations: bruising of the head (face, forehead, and ear) accounted for 41 of 66

TABLE 1 Demographics of Study Subjects, by Presence or Absence of a History of Sentinel Injury

	Definite Abuse				Intermediate Concern		Control	
	AHT		Non-AHT Abuse					
	SI	No SI	SI	No SI	SI	No SI	SI	No SI
	N (%)	*N* (%)	*N* (%)	*N* (%)	*N* (%)	*N* (%)	*N* = 0	*N* (%)
Race/ethnicity, *N* (%)[a]								
White	17 (57)	28 (40)	12 (48)	23 (31)	5 (63)	43 (47)	—	38 (37)
African American	1 (3)	18 (26)	9 (36)	39 (52)	1 (13)	27 (29)	—	33 (33)
Hispanic	3 (10)	20 (28)	2 (8)	6 (8)	—	16 (18)	—	14 (14)
Mixed/other	9 (30)	4 (6)	2 (8)	7 (9)	2 (24)	6 (6)	—	11 (11)
Unknown	—	—	—	—	—	—	—	5 (5)
Gender, *N* (%)								
Male	16 (53)	51 (73)	15 (60)	48 (64)	7 (88)	53 (58)	—	62 (62)
Female	14 (47)	19 (27)	10 (40)	27 (36)	1 (12)	39 (42)	—	39 (39)
Median age, mo	3.8	4.0	4.0	4.0	5.0	5.0	—	4.0
Age range	0.8–11.5	0.5–11.0	1.0–11.5	0.7–11.5	2.0–10.0	0.5–11.0	—	0.1–11.0
Total SI/total	30/100		25/100		8/100		0/101	

[a] SI versus no SI is only significant for AHT × race, $P < .001$. AHT, abusive head trauma; SI, sentinel injury.

sentinel bruises (62.1%), followed in frequency by extremity bruising (14 of 66, 21.2%) and bruising of the trunk (11 of 66, 16.7%). Of the 8 infants with sentinel injuries in the intermediate-concern cohort, 7 (87.5%) had a history of bruising and 1 (12.5%) had a poorly explained subluxation of the radial head. Definitely abused infants were more likely to have a history of a sentinel injury than infants with intermediate concerns (odds ratio: 4.4, 95% confidence interval: 2.0–9.6; $P < .001$). Unlike infants in the other cohorts, none of the infants in the control cohort had a previous sentinel injury ($P < .001$). The initial medical findings that prompted the CPT consultations in the 101 control infants were ultimately diagnosed as accidental injury in 83 (83%), medical mimic in 11 (11%), and a normal variant mistaken for an injury in 6 (6%).

In 23 of the 55 (41.9%) definite-abuse cases with sentinel injury, the parent reported that a medical provider was aware of the injury. Not all of these cases could be confirmed because outside medical records were not always available. In 10 of these 23 cases (43.5%), medical providers suspected abuse, and in 13 (56.5%), there was no evidence suggesting the providers suspected abuse. In some cases for which the provider records were available and abuse was not suspected, the injury was simply noted as a finding on examination, or the injury was diagnosed as accidental, self-inflicted, or a condition unrelated to injury. Some medical providers who suspected abuse made reports to authorities, but the children were not protected, whereas others suspected abuse but concluded there was no abuse because no other injuries were found on the work-up.

Because of the risk of circular reasoning, we analyzed consultation reports to determine if a history of a sentinel injury increased the level of concern for abuse at the time of the initial CPT evaluation. None of the cases of definite abuse were classified as definite abuse because of a sentinel injury. There were no cases in the intermediate-concern cohort in which the level of concern was increased from a low level (levels 1 and 2) to an intermediate level (levels 3-5) on the basis of a history of a sentinel injury. There was 1 case in the intermediate level that had an enhanced level of concern because of a sentinel injury; however, the sentinel injury did not increase the level of concern to definite abuse.

The ages at the time of CPT evaluation and at sentinel injury are depicted by cohort in Fig 3. In the definite-abuse cohorts, these ages were separated by a median of 1 month (range, 1 day to 7.3 months). Of the 52 abused infants for whom the age at first sentinel injury was known, 37 (71%) manifested the sentinel injury at or before 3 months of age, and 52 (94%) at or before 7 months of age.

DISCUSSION

Our study suggests that when an infant is evaluated for possible abuse, a history of a sentinel injury should heighten the concern for abuse. Infants who are not yet cruising have bruises on well-child physical examinations in 0% to 2.2% of cases, according to published research.[9–11] When a bruise is present, it should be considered as potentially sentinel for physical abuse if there is no predisposing disorder or plausible explanation.[5] We found that in the medical history, parents' reports of sentinel injuries are common in abused infants and are rare in infants evaluated for abuse and found to not be abused.

The findings from our study also suggest that in 27.5% of cases of definite physical abuse, there may be escalating and repeated violence toward the infant instead of a single event of momentary loss of control by an angry or frustrated caregiver. The link between early abusive injury and later severe injury is further corroborated by our finding of an intermediate prevalence of sentinel injuries in the cohort in which abuse was suspected but not definitively diagnosed. It is likely that this cohort contains both abused and nonabused infants. Other researchers have demonstrated serial abuse of infants with missed opportunities for prevention.[2–4,6–8] Some abused infants may present for medical care but are missed because their symptoms are mistaken for other

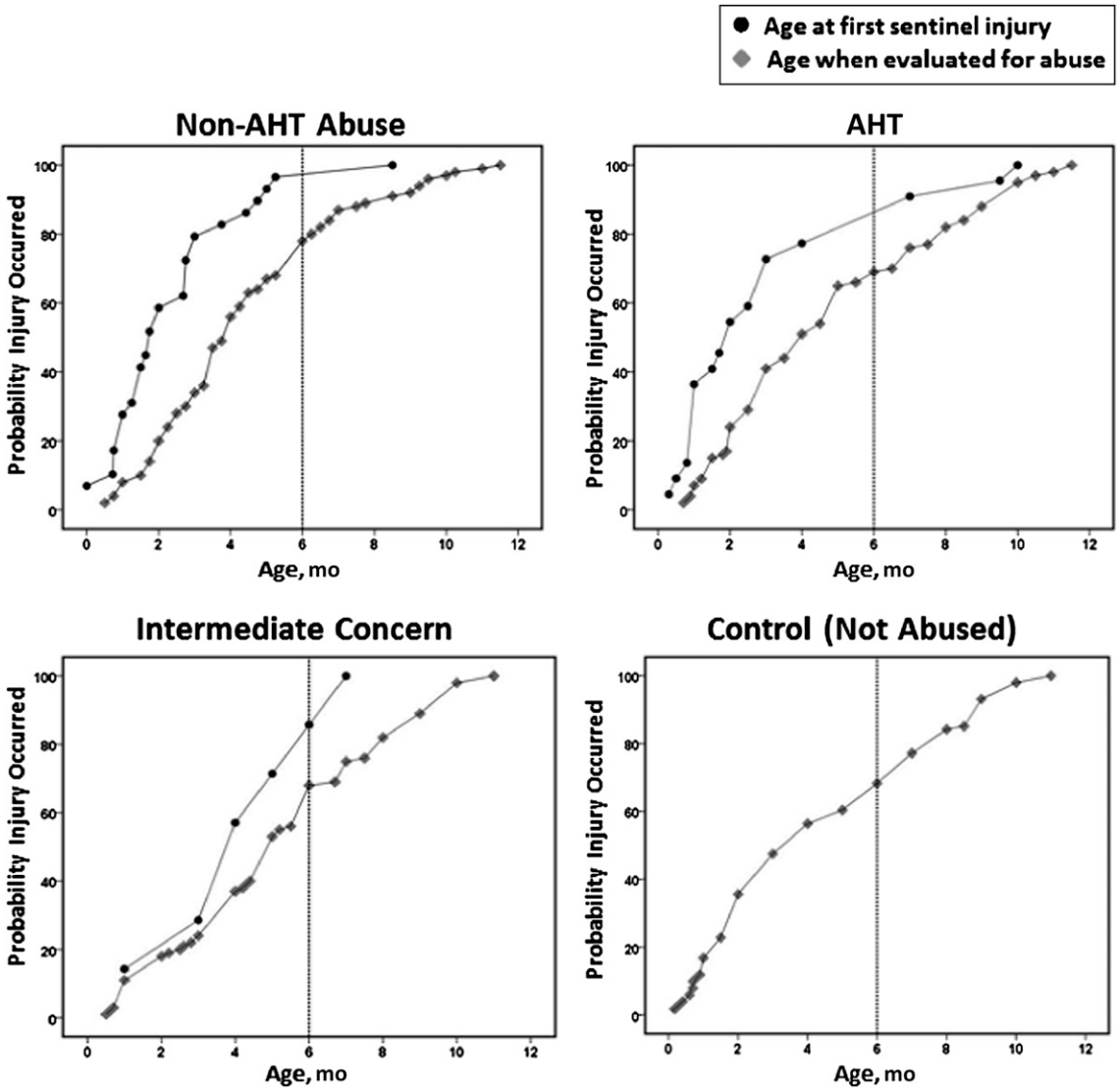

FIGURE 3
Probability of sentinel injury by age in 4 cohorts.

disease processes.[8] Other studies in which researchers examined perpetrator confessions or the presence of other injuries in abused children demonstrate that abuse is often chronic by the time it is definitively diagnosed.[13,14] We are unaware of any published study that describes how often parents report a history of bruising in precruising infants. Our study adds to the literature by showing that there is a high prevalence of caregiver-reported, visible, relatively minor injuries that are concerning for abuse in infants who later suffer abusive injuries, and that a substantial number of these sentinel injuries are known to a medical provider. Appropriate child abuse screening and intervention at the first concern of child physical abuse, such as a history or physical finding of sentinel injury, might prevent many abusive injuries.

Early detection of sentinel injuries and effective evaluation and intervention will require educating caregivers of young infants, child protective service workers, and medical providers about the significance of sentinel injuries. Parents, relatives, public health nurses, home visitors and day care providers should be taught to recognize that bruising and intraoral injuries in precruising infants are unexpected and should prompt medical evaluation. Investigators such as child welfare workers should understand the significance of a bruise and other "minor" injuries in precruising infants as potentially serious and possibly concerning for abuse. Medical providers also play a significant role in child protection. The history of a sentinel injury should prompt a medical provider in any setting to consider abuse

and should heighten the suspicion for abuse in an infant with an injury of indeterminate etiology. In our study, for most sentinel injuries known to a medical provider, there was no evidence from the available records that the medical provider seriously considered abuse. In these cases, the medical provider did not seem to fully recognize the importance of the injury. For example, an intraoral injury was either diagnosed as self-inflicted (eg, "patient scratched self with fingernail" or "chewed on own tongue") or was medically treated without seeking an explanation. In another case, an ankle bruise was noted at a well-baby visit, but the history of the infant "vigorously kicking the crib" was accepted as a plausible cause.

Even in cases in which abuse was considered, medical providers performed an abuse work-up after noticing bruising but seemed to lessen their suspicion of abuse when findings from the work-up indicated no other injuries. A sentinel injury can be the first and only abusive injury. Reporting the sentinel injury to child protective services is appropriate in many cases in which there is no plausible explanation, even when there are no additional occult injuries found. The purpose of the child abuse medical evaluation, such as a computed tomographic scan of the head and skeletal survey, is to detect occult injuries rather than to rule out abuse. A child abuse evaluation that does not show injuries beyond the sentinel injury is different from a negative sepsis evaluation; the former represents additional injury surveillance, and the latter represents medically ruling out a diagnostic consideration. Educational efforts with medical providers should include this important distinction.

With an estimated $210,000 lifetime cost estimate for each case of child physical abuse,[15] prevention of further abuse through early detection and effective intervention has the potential of producing significant financial savings. Our findings suggest that improved detection and management of minor injuries in precruising infants has the potential of preventing up to 27.5% of abuse cases evaluated at a tertiary care children's hospital. Not only should the examination finding of a poorly explained bruise or intraoral injury in a precruising infant raise a concern about abuse, but our study also suggests that simply a history of such injury, particularly in infants being evaluated for abuse, should heighten the concern about abuse. The reliability of using a history of sentinel injuries in screening for abuse requires further exploration.

There are several potential limitations to this study. First, classification of injuries as sentinel relied on the documented histories from parents and is potentially flawed by recall errors and intentional omissions. Recall bias would be expected to affect all 4 cohorts equally, because each infant's evaluation began with a CPT consult for a concerning injury. Furthermore, we relied on documented medical histories that are also affected by thoroughness in medical history-taking and documentation. Given that we only classified a reported injury as a sentinel injury if there was a clear, detailed description provided, we likely undercounted the number of sentinel injuries. Second, our retrospective review would miss fatally abused infants who never presented to the hospital. It is unknown if these cases are different than those included in our study. Third, during chart abstraction, there is a possibility that injuries were misclassified as either sentinel injuries or accidental injuries. Fourth, variations in practice over time and between medical providers could have affected our results. Finally, there is a risk of circular reasoning because the presence of a sentinel injury in the medical history could heighten the level of concern for abuse. This limitation was addressed through additional analysis, as noted previously.

CONCLUSIONS

Many definitely abused infants have a history of minor injuries that occurred before cruising, whereas such injuries are rare in infants evaluated for abuse and found to not be abused. Improved recognition of previous sentinel injuries combined with appropriate interventions would improve secondary prevention of abuse.

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REFERENCES

1. US Department of Health and Human Services, Administration for Children and Families, Administration on Children, Youth and Families, Children's Bureau. (2011). *Child Maltreatment 2010*. Available at: www.acf.hhs.gov/programs/cb/stats_research/index.htm#can. Accessed February 13, 2013
2. Jenny C, Hymel KP, Ritzen A, Reinert SE, Hay TC. Analysis of missed cases of abusive head trauma. *JAMA*. 1999;281(7):621–626
3. Thackeray JD. Frena tears and abusive head injury: a cautionary tale. *Pediatr Emerg Care*. 2007;23(10):735–737
4. Oral R, Yagmur F, Nashelsky M, Turkmen M, Kirby P. Fatal abusive head trauma cases:

consequence of medical staff missing milder forms of physical abuse. *Pediatr Emerg Care*. 2008;24(12):816–821

5. Feldman KW. The bruised premobile infant: should you evaluate further? *Pediatr Emerg Care*. 2009;25(1):37–39
6. Pierce MC, Smith S, Kaczor K. Bruising in infants: those with a bruise may be abused. *Pediatr Emerg Care*. 2009;25(12):845–847
7. Petska HW, Sheets LK, Knox BL. Facial bruising as a precursor to abusive head trauma. *Clin Pediatr*. 2013;52(1):86–88
8. Jenny C. Preventing head trauma from abuse in infants. *CMAJ*. 2009;180(7):703–704
9. Wedgwood J. Childhood bruising. *Practitioner*. 1990;234(1490):598–601
10. Sugar NF, Taylor JA, Feldman KW; Puget Sound Pediatric Research Network. Bruises in infants and toddlers: those who don't cruise rarely bruise. *Arch Pediatr Adolesc Med*. 1999;153(4):399–403
11. Labbé J, Caouette G. Recent skin injuries in normal children. *Pediatrics*. 2001;108(2):271–276
12. Lindberg DM, Lindsell CJ, Shapiro RA. Variability in expert assessments of child physical abuse likelihood. *Pediatrics*. 2008; 121(4). Available at: www.pediatrics.org/content/121/4/e945
13. Alexander R, Crabbe L, Sato Y, Smith W, Bennett T. Serial abuse in children who are shaken. *Am J Dis Child*. 1990;144(1): 58–60
14. Adamsbaum C, Grabar S, Mejean N, Rey-Salmon C. Abusive head trauma: judicial admissions highlight violent and repetitive shaking. *Pediatrics*. 2010;126(3): 546–555
15. Fang X, Brown DS, Florence CS, Mercy JA. The economic burden of child maltreatment in the United States and implications for prevention. *Child Abuse Negl*. 2012;36 (2):156–165

WARMER WEATHER WORRIES AND THE SKI INDUSTRY: *As winter dawns, the temperature drops, and the smell of snow is in the air. For ski aficionados like myself, the promise of powder and the possibility of "fresh tracks" make the winter season particularly exciting. However, concerns about climate change and memories of last winter – the fourth warmest on record since 1896 – worry ski resort operators. As reported by* The New York Times *(U.S.: December 12, 2012), a recent report from the National Resources Defense Council and the Protect Our Winters organization suggests that a warming climate will be bad news for the United States ski industry. Rising temperatures will lead to less snowfall, particularly on the more southern mountains, and will also limit the ability to make snow (a process requiring cold temperatures). With upwards of 80% of the nation's resorts utilizing snowmaking equipment to supplement natural snowfall, the current $500,000 annual cost of snowmaking will likely rise. The report also emphasizes the possibility of significant job losses for those employed by winter resorts. It is important to highlight that years of higher snowfall (such as 2010-2011) often balance out those of lower snowfall and can potentially keep the industry running. Even with this in mind, the industry is adjusting to weather changes – many resorts now include zip-lining, alpine sliding, hiking, and mountain biking for year-round entertainment. Hopefully, for those of us who look forward to gliding down the slopes at winter resorts, these attractions will be merely an added bonus.*

Noted by Leah H. Carr, BS, MS-III

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