

WI CAN Educational Series
2/17/2023

High Stakes Bruising – Evidence-Based Guidance

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Disclosure Information for:
Dr. Lynn Sheets



- Learners must attend the entire one-hour session and complete an evaluation to receive contact hours. There will be a code to text confirming attendance. The code and phone number will be displayed at the end of the session.

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Learning Objectives

- Name and describe an evidence-based clinical tool to assess bruising beyond infancy
- Define the term "sentinel injury" in infants
- Describe at least 3 ways to help determine if a skin finding is a bruise




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Outline

- Bruises in general
- When in doubt – Is it a bruise or not or unknown?
- Bruising in young childhood
 - Infants – sentinel injuries
 - Mobile children – normal or worrisome?
- Public Health perspective on child abuse prevention and bruises




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A Bruise

- Like a scratch, a bruise is commonly thought of as trivial and easily identifiable
- We are all experts! 😊 Or are we?
- In practice, medical providers struggle to identify, name, and take appropriate action if the bruise has potential significance
- Definition per Stedman's Medical Dictionary - A blunt injury producing a hematoma or diffuse extravasation of blood without rupture of the skin.
- Petechial bruising can be from blunt trauma, pressure changes inside small blood vessels, 'leaky' blood vessels from a variety of causes




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Characteristics of Bruises

- Caused by blunt trauma – crush, high velocity impact, shearing/crimping of the skin, pressure changes in capillaries (leading to petechial bruising)
- May have tenderness to palpation
- Does not blanch with pressure or by pulling the skin taught (see photo examples)
- Does not wipe off
- Changes with time – color and visibility – it heals
- In darker, melanated skin, ask parent about bruising and use moisturizing lotion to improve visualization




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High Stakes?

- Bruising in infancy is completely unexpected in routine care and handling.
- **Even common unintentional events often do not cause bruising.** Falls from beds/arms of caregiver – only ~8% had a bruise in < 6-months of age*
- Laying on or against an object is not expected to cause bruises
- Bruising can be a sign of abuse, or, less often, a sign of a bleeding disorder
- Consideration of abuse should be first and foremost
- There is no way to 'screen' for abuse in infants
 - Essential to screen for hidden, occult injuries, but lack of these is common even when the initial bruise is from abuse
 - The consideration for abuse with testing and reporting is an intervention

*Warrington SA, Wright CM; ALSPAC Study Team. Accidents and resulting injuries in premobile infants: data from the ALSPAC study. Arch Dis Child. 2001 Aug;85(2):104-7. doi: 10.1136/adc.85.2.104. PMID: 11465183; PMCID: PMC1718686.

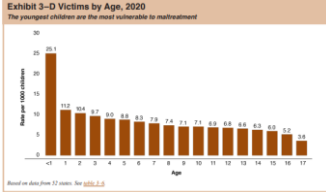


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Infant Bruising – A Chance to Save a Life*


The victimization rate is highest for children younger than 1 year old at 25.1 per 1,000 children in the population of the same age.^



Age	Rate per 100 children
0	25.1
1	10.2
2	9.4
3	9.7
4	9.0
5	8.8
6	8.5
7	8.4
8	8.4
9	8.4
10	8.4
11	7.4
12	6.8
13	6.8
14	6.5
15	5.7
16	5.7
17	0.8

Based on data from 37 states. See [table 2.1](#).

Sentinel Injuries: A Chance to Save a Life ([aap.org](#))
 ^Child Maltreatment 2020 ([hhs.gov](#))




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Commission to End Child Abuse and Neglect Fatalities Study: 2016-2018

“Every state should review their **policies on screening reports** of abuse and neglect to ensure that the children most at risk for fatality—those under age 3—receive the appropriate response, and they and their family are prioritized for services, with **heightened urgency for those under the age of 1.**”

Focus today is on infants and then on other young, preverbal/early verbal children



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Infant Bruising

Sentinel Injury




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What is a Sentinel Injury?

- Visible, medically minor, unexpected injuries in a pre-cruising infant:
 - Bruising
 - Subconjunctival hemorrhages
 - Frenum and any mouth injury



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To learn more: <http://uwm.edu/mcwp/sentinel-injuries/>

Child Welfare Partnership

Marks that Matter: Sentinel Injuries, and Other Opportunities for Child Abuse Prevention

This 20-minute module will teach you about sentinel (or marker) and sentinel injuries, including why they are significant, what to look for, and what to do if you suspect abuse. It is intended for childcare workers, child welfare workers, family support staff, and home visitors, but any person working with children will find it a good read.

Click the image below to view the training. This media can be viewed on your computer or mobile device.

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Infant Safety

- Responsibility borne by society
- Who has a role in infant safety?
 - Parents/guardians
 - Family
 - Social networks including faith community
 - Daycare/childcare
 - Home visitors
 - Medical professionals
 - Child Welfare
 - Law Enforcement
 - Courts

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Finding Safety – Is it Just a Bruise?

- Multidisciplinary evaluation and response is needed
 - Effective intervention requires a multidisciplinary response
 - Complete medical evaluation including occult injury screening and report are an intervention
 - In most, but not all, cases of sentinel injury, the maltreater, if one exists, may never be known

Family (and community, SOH)

Police

Child protective services

Health care

Infant Safety

Opportunity for better mutual understanding

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Isolated Bruising – Is It Abuse?

- Isolated bruising in pre-cruising infants evaluated for abuse*
 - < 6 months old evaluated for abuse
 - 50% have other serious injury identified on skeletal survey, neuroimaging or abdominal injury screening
 - 70% were screened for bleeding disorders and **none** identified
 - **Bruising can be the first injury from abuse**
- Isolated bruising associated with skeletal injury in 1/3 of cases in a prospective study^A

*Harper NS et al. Additional Injuries in Young Infants with Concern for Abuse and Apparently Isolated Bruises J Pediatr 2014;165(2):383-388

^ACrumm CE, Brown ECB, Thomas-Smith S, Yu DTY, Metz JB, Feldman KW. Evaluation of an Emergency Department High-Risk Bruising Screening Protocol. Pediatrics. 2021;147(4):e2020002444. doi:10.1542/peds.2020-002444

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History Per Mother

•The child's mother did not know that the bruises and subconjunctival hemorrhages were unexpected. Her impressions were reinforced by medical providers and others' seeming lack of concern about these medically minor, sentinel injuries.

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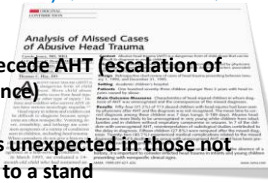
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Missed AHT – 1999 Jenny (JAMA 1999; 281:621-626)

1. Be alert for bruises or abrasions on the faces or heads of children presenting with no facial or head bruises precede AHT (escalation of violence)

Cites Wedgwood – bruises unexpected in those not yet pulling to a stand



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Injury From Abuse Can Escalate

- Injury from abuse can escalate
- Prevention critical
 - Frena tears and abusive head injury: A cautionary tale. Thackeray JD. *Pediatr Emerg Care.* 2007;23(10):735-737
 - Fatal abusive head trauma cases: Consequence of medical staff missing milder forms of physical abuse. Oral R, Yagmur F, Nashelsky M, Turkmen M, Kirby P. *Pediatr Emerg Care.* 2008;24(12):816-821
 - The Bruised Premobile Infant: Should You Evaluate Further? Feldman KW. *Pediatr Emer Care.* 2009;25:37-39
 - Bruising in Infants: Those With a Bruise May Be Abused. Pierce MC, Smith S, Kaczor K. *Pediatr Emer Care.* 2009;25:845-847
 - Facial Bruising as a Precursor to Abusive Head Trauma. Petska HW, Sheets LK, Knox BL. *Clin Pediatr*, published on-line 4/17/2012



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At What Cost?

- Reporting is not benign
- Responsibility and mandate to report should not be taken lightly
- However, the stakes of not performing occult injury screen and reports are exceedingly high
- Remember that threshold for mandated report is well below diagnostic certainty
- Bruising is not normal or expected in infancy until developmental stage of cruising
- Age vs developmental stage. . .



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Bruising in Infancy – Correlated to Gross Motor Skills



Bruising is unexpected in infants who are not yet able to try to walk while holding onto a stationary object (cruising).


2022 normed developmental data uses 6 months for rolling tummy to back and 12 months for cruising.

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Age or Stage? . . . Or both?

- Bruising was rare before 9 months 1982 Robertson DM, Barbor P, Hull D. (Unusual injury? Recent injury in normal children and children with suspected non-accidental injury. Br Med J (Clin Res Ed). 1982;285(6352):1399-1401. doi:10.1136/bmj.285.6352.1399)
- Age is not as useful as developmental stage
 - Wedgwood J. (Childhood bruising. Practitioner. 1990;234(1490):598-601)
 - Sugar 1999 (Sugar N et al. Bruises in Infants and Toddlers: Those Who Don't Cruise Rarely Bruise. Arch Pediatr Adolesc Med. 1999;153:399-403)
- Used a phrase to help people (lay and medical) remember that:

Those Who Don't Cruise Rarely Bruise




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Bruising in Infancy Is Unexpected Until the Infant Is Cruising

Published science has created a foundation of evidence that infant injury is *unexpected* until a child is cruising (normed age is 12 months).



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Bruising in Infancy

- Common myths:
 - Most people are 'experts' in bruising due to universal experience
 - Bruising alone is "medically trivial"
 - Infants are fragile, tender, and easily bruised
- Corrections:
 - While the experience of a bruise is universal, interpretation of bruising is nuanced
 - While the bruise, itself, is trivial, the significance is not[^]
 - Infants are less easily bruised than older children*

*Ermertcan, A., & Ertan, P. (2010). Skin manifestations of child abuse. Indian journal of dermatology, venereology and leprology, 76(4), 317.

[^]Sugar NF, Taylor JA, Feldman KW. Bruises in infants and toddlers: those who don't cruise rarely bruise. Arch Pediatr Adolesc Med. 1999;153(4):399-403



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Sentinel Injuries = Unexpected, Medically Minor, Visible Injuries in Pre-Cruising Infants

- Why the term?
- Like The Joint Commission's term of "sentinel event," a sentinel injury:
 - Is important
 - Is urgent
 - Needs immediate investigation and response
 - Needs analysis to prevent further harm

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Public Health Perspective – Who Sees Infants Bruising on Infants?

Some bruises in infancy are observed by clinicians, but many are observed only by regular caregivers or family.

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Asking About Sentinel Injuries

- Scripts help
- **Universal education** helps "immunize" children by educating caregivers
- Sentinel injuries can be detected by history (medical records and caregiver query) and/or physical examination

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The Sentinel (History of as an early warning) and the Sign (on exam)

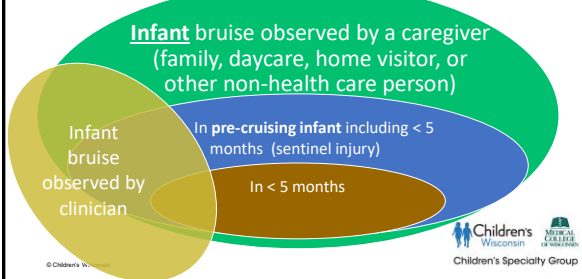
- History - Parent or Caregiver report
 - Sentinel injury study – parents reported bruising and other injuries when asked
 - Have you ever seen a bruise on your baby? If yes, ask where it was, what it looked like, how long it lasted, and what might have caused it
 - Ask if the bruise is in any photos
 - Have you ever seen bleeding from the mouth?
- Examination
 - Parent observes injury and points it out
 - Medical provider on physical examination
 - Other professional observes injury (eg daycare, home visitor)



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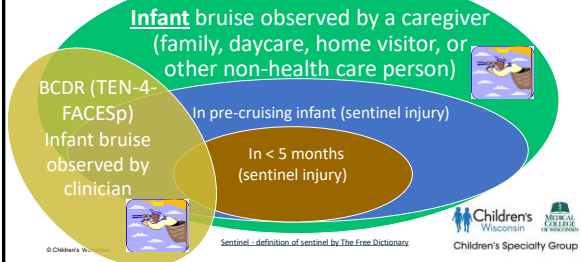
Infant Bruising Who sees the bruise?



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Prevention Opportunities



Sentinel - definition of sentinel by The Free Dictionary



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Toddlers – 4 years

TEN-4-FACESp Clinical Concerns

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Bruising – Screening For Abuse

Open
Full Text Available
Evaluation of a Clinical Decision Rule to Predict Abuse in Young Children Based on Bruising Characteristics
Journal of Child Abuse and Neglect
Volume 46, Issue 1, February 2022, Pages 1-11
DOI: 10.1016/j.jcna.2021.10.005

- Ideally, screening tests should cast a wide net, have clear terminology, clear definition. (1999 ICM)
- While the net is cast, it is important to exercise caution. What information is missing?
- Expert review panel classified all cases as abuse, non-abuse, or indeterminate
- Surprisingly, in this study cases were largely determined to be either abuse (19%) or non-abuse (80%) with only 1.2% were considered indeterminate

Institute of Medicine (US) Committee on Perinatal Transmission of HIV, National Research Council (US) and Institute of Medicine (US) Board on Children, Youth, and Families, Stoto MA, Almaro DA, McCormick MC, editors. Reducing the Odds: Preventing Perinatal Transmission of HIV In The United States. Washington (DC): National Academies Press (US); 1999. 2. Public Health Screening Programs.

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Gold Standard for Physical Abuse?

- Diagnostic certainty is sometimes achievable in consultations by child abuse medical professionals
- Nationally, the data demonstrate that about 50% of time, cases are indeterminate. Johnson KL, Brown ECB, Feldman KW, Qu P, Lindberg DM; EXSTRA Investigators. Child Abuse Pediatr Assess a Low Likelihood of Abuse in Half of 2890 Physical Abuse Consults. Child Maltreat. 2022 May;27(2):202-208. doi: 10.1177/10775595211041974. Epub 2021 Sep 24. PMID: 34559018.
- Some indeterminate cases result in indications/substantiations or in criminal convictions
- Gold standard – medical, child protection team in some cases, but in many cases, medical certainty is elusive

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Binary Thinking – Perils of Overconfidence

When information is not complete, e.g., failure to perform a skeletal survey in a bruised infant, conclusions are rife with risk of cognitive errors:

- You don't know what you don't see – failure to ask about, look for on an undressed exam, and perform screening for occult injury
- Cognitive errors from negative screening – many people use diagnostic evaluations as a "test" for abuse or to "rule out" abuse as noted. These are surveillance studies for occult injuries
- Bias – conscious ("motivated reasoning") and unconscious

Berner ES, Graber ML. Overconfidence as a cause of diagnostic error in medicine. Am J Med. 2008;121(5 Suppl):S2-S23. doi:10.1016/j.amjmed.2008.01.001



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Challenges

- Three decision thresholds are likely different:
 - Mandated reporting
 - Performing the diagnostic studies to detect predisposing medical conditions and occult injury
 - Diagnosis – no gold standard for infant bruising
- Use of a cognitive 'trigger' (such as the term, 'sentinel injury' for these medically minor injuries) to even consider child physical abuse and to surveil for occult injuries and predisposing conditions is important
- Screening for occult injury is a key step in making a diagnosis but absence of other injury **does not** rule out abuse

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Best of the Evidence – Approach to Bruising

- **Pre-cruising** (or < 12 mo) – sentinel injuries are any bruise, subconjunctival hemorrhage, or mouth injury and should cause concerns about abuse (and rarely a bleeding disorder)
- **Cruising/walking to age 48 months (4 y/o)** – modified TEN-4-FACESp: **T**runk, **E**ar, **N**eck, **F**renulum (often accidental), **A**ngle of jaw, **C**heek (padded part), **E**yelid, **S**ubconjunctival hemorrhage in < 2 y/o, or **P**atterned injury (any age child)

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Putting It Together For Prevention




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Clinical Judgment Regarding Bruising – Age, Stage, AND Other

- **Clinical judgment should be guided by evidence**
 - **Sentinel Injury?** Young infants are not expected to have a bruise until they cruise as these are one type of sentinel injury
 - **Coagulopathy?** Bruising in infants – when is it a coagulopathy or abuse? (See 2022 Anderst J, Carpenter SL, Abshire TC, et al.)
 - **Bruising in < 4-years-old** – when do concerns about abuse warrant further testing? (See 2021 Pierce MC, Kaczor K, Lorenz DJ, et al.)

Cruising – see Zubler JM, Wiggins LD, Macias MM, et al. Evidence-Informed Milestones for Developmental Surveillance Tools. Pediatrics. 2022;149(3):e2021052138



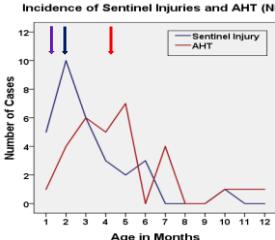
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Ages at Risk


- Crying normally peaks at 1-2 months*
- Sentinel Injuries peaked at 2-3 months
- Abusive head trauma peaks at 3-6 months

Incidence of Sentinel Injuries and AHT (N=30)



Age in Months	Sentinel Injury (Number of Cases)	AHT (Number of Cases)
1	0	0
2	10	0
3	6	6
4	4	6
5	2	7
6	0	4
7	0	0
8	0	0
9	0	0
10	0	1
11	0	1
12	0	1

Brazelton, T. B. (1962). Crying in infancy. Pediatrics, 29, 579-588.



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Infant Distress & Sentinel Injury

- Infant distress was associated with abuse (67.9% vs 44.7%; P = .008; OR, 2.6; 95% CI, 1.3-5.2)
- Infants with sentinel injuries had higher rates of infant distress (74.1% vs 42.4%; P ≤ .001) and crying (81.5% vs 62.7%; P = .012).
- Sentinel injuries were the most important predictor of abuse followed by infant distress

Rabbitt AL, Olson NL, Liegl MN, Simpson P, Sheets LK. Caregiver Reports of Infant Distress and Injury in Abused Infants. *J Pediatr.* 2022 Jun;245:190-195.e2. doi: 10.1016/j.jpeds.2022.02.056. Epub 2022 Mar 26. PMID: 35351533.



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Response to Sentinel Injury Can Change the Trajectory of Safety

What if every mother, father, relative, primary care provider, and daycare worker knew that bruising and other sentinel injuries are UNEXPECTED in infants who have not yet started trying to walk?

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Education (and Clinical Decision Rules and Clinical Pathways Are Not Enough)

- Residents, primary care providers, and subspecialists need more tools than just education – protocols, clinical decision rules, clinical decision support
- Barriers to making evidence-based decisions are many
- Stakes are very high

Tyagura G, Goveel M, Koziel IR, Asnes A, Bechtel K. Barriers and Facilitators to Detecting Child Abuse and Neglect in General Emergency Departments. *Ann Emerg Med.* 2015;66(5):447-454. doi:10.1016/j.annemergmed.2015.06.020

Esquivel A, Pastrana I, Marshall V, Lukefahr JL, Mitchell I. The Implementation of a Pediatric Nonaccidental Trauma Evaluation Protocol: A Quality Improvement Analysis. *Pediatr Emerg Care.* 2020;36(2):e61-e65. doi:10.1097/PEC.0000000000001581

Pierce MC, Kaczor K, Lorenz DJ, et al. Validation of a Clinical Decision Rule to Predict Abuse in Young Children Based on Bruising Characteristics [published correction appears in *JAMA Netw Open.* 2021 Sep 1;4(9):e2130136]. *JAMA Netw Open.* 2021;4(4):e215832. Published 2021 Apr 1. doi:10.1001/jamanetworkopen.2021.5832

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Medical Professionals Miss Child Abuse - Why?

- Bias – more likely to be missed if white, 2 parent home, age < 6 months, non-pediatric ED
- Abuse not considered in the DDX or Injury is presumed to be self-inflicted or due to normal care (Sheets 2013)
- Screening for occult (internal, asymptomatic injuries) not performed or negative screen is perceived as abuse ruled out
- Abuse is emotionally charged, strains relationships, and slows a clinic or ED
- **Consideration of abuse creates more work and requires critical thinking**

Jenny C, Hynd KD, Rosen A, Reinert SE, Hay TC. Analysis of missed cases of abusive head trauma [published correction appears in JAMA 1999 Jul 7;282(1):29]. JAMA. 1999;281(7):621-626. doi:10.1001/jama.281.7.621

Jackson AM, et al. Curiosity and Critical Thinking: Identifying Child Abuse Before It's Too Late. Clinical Pediatrics 2015, Vol. 54(1) 54-61

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Strategies To Avoid Missing Abuse

- Education, include guidelines in Child Welfare standards, clinical decision support including scripting/other just in time tools
- Pay attention to variance from guidelines and explore why it occurred
- Discuss difficult decisions and what tools could help to improve confidence and comfort
- Neurodevelopmental trauma is often coexistent with child abuse injury – the "hidden" danger of "failure to rescue"
- Words guide thinking – educate families and use the term "sentinel injury"
- Use BCDR TEN-4-FACEs for children > 12 months and < 4 years
- Avoid the "hope for the best" strategy of gaze aversion

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Selected References (also see slides)

- Anderst J, Carpenter SL, Abshire TC, et al. Evaluation for Bleeding Disorders in Suspected Child Abuse. Pediatrics. 2022;150(4):e2022059276. doi:10.1542/peds.2022-059276
- Asnes AG, Leventhal JM. Bruising in Infants: An Approach to the Recognition of Child Physical Abuse. Pediatr Rev. 2022 Jul 1;43(7):361-370. doi:10.1542/pir.2022-001271. PMID: 35773541
- Atwal GS, Rutty GN, Carter N, Green MA. Bruising in non-accidental head injured children: a retrospective study of the prevalence, distribution and pathological associations in 24 cases. Forensic Sci Int. 1998;96(2-3):215-230. doi:10.1016/s0579-0738(98)00126-1
- Berger RP, Saladino RA, Fromkin J, Heineman E, Suresh S, McGinn T. Development of an electronic medical record-based child physical abuse alert system. J Am Med Inform Assoc. 2018;25(2):142-149. doi:10.1093/jamia/ocx063
- Christian CW. Professional education in child abuse and neglect. Pediatrics. 2008;122(suppl 1):S13-S17.
- Cuff PA, Vanselow NA, eds. Improving Medical Education: Enhancing the Behavioral and Social Science Content of Medical School Curricula. Washington, DC: National Academies Press; 2004.
- Ely JW, Graber ML, Croskerry P. Checklists to reduce diagnostic errors. Acad Med. 2011;86(3):307-313. doi:10.1097/ACM.0b013e3181920824cd
- Feldman KW, Bethel R, Shugerman RP, Grossman DC, Grady MS, Ellenbogen RG. The cause of infant and toddler subdural hemorrhage: a prospective study [published correction appears in Pediatrics. 2021 Feb;147(2)-]. Pediatrics. 2001;108(3):636-646. doi:10.1542/peds.108.3.636

45

- Flaherty EG, Sege R. Barriers to physician identification and reporting of child abuse. *Pediatr Ann.* 2005;34:349-356.
- Frankenburg WK, Dodds JB. The Denver developmental screening test. *J Pediatr.* 1967;71(2):181-191. doi:10.1016/s0022-3476(67)80070-2
- Henry MK, Wood JN. What's in a name? Sentinel injuries in abused infants. *Pediatr Radiol.* 2021 May;51(6):861-865. doi: 10.1007/s00247-020-04915-7. Epub 2021 May 17. PMID: 33999230.
- Jenny C, Hymel KP, Ritzen A, Reinert SE, Hay TC. Analysis of missed cases of abusive head trauma [published correction appears in *JAMA* 1999 Jul 7;282(1):29]. *JAMA.* 1999;281(7):621-626. doi:10.1001/jama.281.7.621
- Khan AN, Rubin DH, Winnik G. Evaluation of the mandatory child abuse course for physicians: do we need to repeat it? *Public Health.* 2005;119:626-631.
- Krugman RD. Ending Gaze Aversion Toward Child Abuse And Neglect. *Health Aff (Millwood).* 2019;38(10):1762-1765. doi:10.1377/hlthaff.2019.00573
- Oral R, Yaşar 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;24:816-821.
- Petska HW, Sheets LK, Knox BL. Facial bruising as a precursor to abusive head trauma. *Clin Pediatr (Phila).* 2013;52:86-88.
- Pierce MC, Kaczor K, Lorenz DJ, et al. Validation of a Clinical Decision Rule to Predict Abuse in Young Children Based on Bruising Characteristics. [published correction appears in *JAMA Netw Open.* 2021 Sep 1;4(9):e2130136]. *JAMA Netw Open.* 2021;4(4):e215832. Published 2021 Apr 1. doi:10.1001/jamanetworkopen.2021.5832

46

- Ravichandiran N, Schuh S, Bejuk M, et al. Delayed identification of pediatric abuse-related fractures. *Pediatrics.* 2010;125:60-66
- Sheets LK, Leach ME, Koszewski IJ, Lessmeier AM, Nu-gent M, Simpson P. Sentinel injuries in infants evaluated for child physical abuse. *Pediatrics.* 2013;131:701-707
- Starling SP, Heisler KW, Paulson JF, Youmans E. Child abuse training and knowledge: a national survey of emergency medicine, family medicine, and pediatric residents and program directors. *Pediatrics.* 2009;123:e595-e602.
- Warner-Rogers JE, Hansen DJ, Spieth LE. The influence of case and professional variables on identification and reporting of physical abuse: a study with medical students. *Child Abuse Negl.* 1996;20:851-866.
- Wright RJ, Wright RO, Farnan L, Isaac NE. Response to child abuse in the pediatric emergency department: need for continued education. *Pediatr Emerg Care.* 1999;15:376-382.
- Zubler JM, Wiggins LD, Macias MM, et al. Evidence-Informed Milestones for Developmental Surveillance Tools. *Pediatrics.* 2022;149(3):e2021052138

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Selected References (also see slides)

- Anderst J, Carpenter SL, Abshire TC, et al. Evaluation for Bleeding Disorders in Suspected Child Abuse. *Pediatrics*. 2022;150(4):e2022059276. doi:10.1542/peds.2022-059276
- Asnes AG, Leventhal JM. Bruising in Infants: An Approach to the Recognition of Child Physical Abuse. *Pediatr Rev*. 2022 Jul 1;43(7):361-370. doi: 10.1542/pir.2022-001271. PMID: 35773541
- Atwal GS, Ruttly GN, Carter N, Green MA. Bruising in non-accidental head injured children; a retrospective study of the prevalence, distribution and pathological associations in 24 cases. *Forensic Sci Int*. 1998;96(2-3):215-230. doi:10.1016/s0379-0738(98)00126-1
- Berger RP, Saladino RA, Fromkin J, Heineman E, Suresh S, McGinn T. Development of an electronic medical record-based child physical abuse alert system. *J Am Med Inform Assoc*. 2018;25(2):142-149. doi:10.1093/jamia/ocx063
- Christian CW. Professional education in child abuse and neglect. *Pediatrics*. 2008;122(suppl 1):S13-S17.
- Cuff PA, Vanselow NA, eds. *Improving Medical Education: Enhancing the Behavioral and Social Science Content of Medical School Curricula*. Washington, DC: National Academies Press; 2004.
- Ely JW, Graber ML, Croskerry P. Checklists to reduce diagnostic errors. *Acad Med*. 2011;86(3):307-313. doi:10.1097/ACM.0b013e31820824cd.
- Feldman KW, Bethel R, Shugerman RP, Grossman DC, Grady MS, Ellenbogen RG. The cause of infant and toddler subdural hemorrhage: a prospective study [**published correction appears in *Pediatrics*. 2021 Feb;147(2):**]. *Pediatrics*. 2001;108(3):636-646. doi:10.1542/peds.108.3.636

- Flaherty EG, Sege R. Barriers to physician identification and reporting of child abuse. *Pediatr Ann.* 2005;34:349-356.
- Frankenburg WK, Dodds JB. The Denver developmental screening test. *J Pediatr.* 1967;71(2):181-191. doi:10.1016/s0022-3476(67)80070-2
- Henry MK, Wood JN. What's in a name? Sentinel injuries in abused infants. *Pediatr Radiol.* 2021 May;51(6):861-865. doi: 10.1007/s00247-020-04915-7. Epub 2021 May 17. PMID: 33999230.
- Jenny C, Hymel KP, Ritzen A, Reinert SE, Hay TC. Analysis of missed cases of abusive head trauma [published correction appears in *JAMA* 1999 Jul 7;282(1):29]. *JAMA.* 1999;281(7):621-626. doi:10.1001/jama.281.7.621
- Khan AN, Rubin DH, Winnik G. Evaluation of the mandatory child abuse course for physicians: do we need to repeat it? *Public Health.* 2005;119:626-631.
- Krugman RD. Ending Gaze Aversion Toward Child Abuse And Neglect. *Health Aff (Millwood).* 2019;38(10):1762-1765. doi:10.1377/hlthaff.2019.00573
- 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;24:816-821.
- Petska HW, Sheets LK, Knox BL. Facial bruising as a precursor to abusive head trauma. *Clin Pediatr (Phila).* 2013;52:86-88.
- Pierce MC, Kaczor K, Lorenz DJ, et al. Validation of a Clinical Decision Rule to Predict Abuse in Young Children Based on Bruising Characteristics [published correction appears in **JAMA Netw Open.** 2021 Sep 1;4(9):e2130136]. *JAMA Netw Open.* 2021;4(4):e215832. Published 2021 Apr 1. doi:10.1001/jamanetworkopen.2021.5832

- Ravichandiran N, Schuh S, Bejuk M, et al. Delayed identification of pediatric abuse-related fractures. *Pediatrics*. 2010;125:60-66
- Sheets LK, Leach ME, Koszewski IJ, Lessmeier AM, Nugent M, Simpson P. Sentinel injuries in infants evaluated for child physical abuse. *Pediatrics*. 2013;131:701-707
- Starling SP, Heisler KW, Paulson JF, Youmans E. Child abuse training and knowledge: a national survey of emergency medicine, family medicine, and pediatric residents and program directors. *Pediatrics*. 2009;123:e595-e602.
- Warner-Rogers JE, Hansen DJ, Spieth LE. The influence of case and professional variables on identification and reporting of physical abuse: a study with medical students. *Child Abuse Negl*. 1996;20:851-866.
- Wright RJ, Wright RO, Farnan L, Isaac NE. Response to child abuse in the pediatric emergency department: need for continued education. *Pediatr Emerg Care*. 1999;15:376-382.
- Zubler JM, Wiggins LD, Macias MM, et al. Evidence-Informed Milestones for Developmental Surveillance Tools. *Pediatrics*. 2022;149(3):e2021052138