# Shedding light on non-accidental bruising

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In 1988, I was first asked to give evidence in court in a case of suspected child abuse. I can recall that at that time there was little published research on which to base an opinion. There were certainly plenty of ex cathedra statements in textbooks but all too often this orthodoxy was not founded on empirical science.[1] Over 25 years later, it is gratifying to see the extent to which research on non-accidental injury has come out of the shadows. The members of the research team at Cardiff University have been leaders in this field.

The developments of the last quarter century read like a textbook for medical students on different methodological approaches to a research question. Initially, there were case reports and small, single centre case series.[2] Then the important cross-sectional study from Montreal.[3] This was followed by case control studies.[4] Now we have a longitudinal study.[5]

The authors criticise other studies for using selected populations, such as children attending baby clinics and outpatient appointments. However, this study also recruited children from selected well-baby clinics, hospital outpatient clinics and mother and baby groups. So it was not a geographical cohort study. Nor were the children representative of the population from which they were drawn—46% of the children were from the least deprived quintile and only 15% from the two most deprived quintiles. However, children from the most deprived quintile were 1.56 times more likely to have a bruise than children from the least deprived quintile so the overall prevalence of bruises recorded is likely to be an underestimate of the general population. The study may also have underestimated the prevalence of bruising in the child population because of sampling bias. Bruising was recorded from 328 children out of 1002 approached. It is possible that parents of children with more extensive bruising were over-represented in those who declined to consent.

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Equally, it is also theoretically possible that the number of bruises or the sites of bruising in this study were an overestimate of truly accidental bruising. One can never be certain that all of the bruises witnessed and recorded in a research study were incurred accidentally.

The design was of a longitudinal study. However, only 40 of the 328 children recruited spanned the first two developmental stages from premobile (age range 0–11 months) to early mobile (age range 4–18 months) phases. Only 27 of the 328 children recruited spanned the two later developmental stages from early mobile to walking (age range 10–70 months) phases.

Despite these observations, this study makes a significant contribution to the published literature by increasing the evidence base. The study underlines the old adage that an abnormal number and distribution of injuries increases the likelihood that the injuries have a non-accidental explanation.[6] The more bruises that are present, the greater the index of suspicion, especially in premobile infants. Only 1 in 20 premobile children in this study had bruising. Between 4–18 months, approximately half of the children had bruising but the 90th centile for the total number of bruises was two bruises in total.

The site of bruising is also important. In this study, bruising to the ears, neck, genitalia and hands was rare in any age group and bruising to the buttocks was rare before 18 months of age.

The longitudinal nature of the study design does throw up some additional interesting findings. Different children tend to have different amounts of bruising over time—but is this because the child 'bruises easily' or because a more neglectful parenting environment is sustained over time?

Having a sib increases the number of bruises. Is this because parents have their hands full with an older toddler or are preoccupied with a new baby? Or is an older sib causing bruising in a younger child through inappropriate rough and tumble or jealousy? Was the risk related to the age of the sibling?

Few bruises are pathognomonic of non-accidental injury. In this study, two bruises to the cheek were noted from multiple data collections from premobile infants and two bruises to the ear in collections from early mobile infants—both rare sites for accidental injuries in any age group in my experience. However, as in almost all research which records injuries in children, there can never be certainty that these occurred accidentally.

An algorithm which allows the clinician to enter the number of bruises, the sites, the age of the child and produces a probability of such a pattern arising by chance could be an interesting output from the data in this study, perhaps combined with other published studies. If time series data could also be incorporated from this longitudinal study, this could provide a more powerful assessment of the likelihood that a particular pattern of bruising over time was due to repeated accidents.

The challenge for a judge in a child protection case that comes to court is how to apply probabilistic arguments to an individual child. As the authors themselves state, because of the multiple collections from individual children the prevalence of bruising in individual children at one time point cannot be easily calculated from these data. The authors use the first collection from each child to give an estimation of the prevalence of bruising in premobile children as 5.3%. However within this developmental group, bruising in babies who were not yet rolling over was significantly less common than in those who could roll over but were not yet crawling (2.2% (9/405) vs. 9.8% (59/605) across multiple data collections). Faced with a child with bruising to the ear, the judge will be told that following multiple collections (2570) in 328 children an accidental bruise was recorded in 0.1% (3) of collections. So it is true that almost any injury can, albeit very rarely, occur accidentally at any developmental stage or at any site. It is the pattern of bruising, taken in totality, which gives additional context. Sadly, lawyers for the various parties involved in suspected child abuse cases still often focus on each injury in isolation, one by one. In contrast, paediatricians are trained to take a holistic view—how likely is it that this pattern of injuries, with their distribution in time and space, is due to accidental causes?

**Correction notice** This paper has been amended since it was published Online First. In paragraph 10, the second sentence has been changed with the addition of the underlined words: "Few bruises are pathognomonic of non-accidental injury. In this study, two bruises to the cheek were noted from multiple data collections from premobile infants and two

bruises to the ear in collections from early mobile infants—both rare sites for accidental injuries in any age group in my experience." In addition to these changes, the final paragraph has been revised.

**Competing interests** 1 December 2011–31 October 2014 Board of Trustees, NSPCC.

**Provenance and peer review** Commissioned; internally peer reviewed.

**To cite** Stephenson T. *Arch Dis Child* Published Online First: [*please include* Day Month Year] doi:10.1136/archdischild-2014-307869

Received 7 January 2015
Accepted 14 January 2015

▶ http://dx.doi.org/10.1136/archdischild-2014-307120

*Arch Dis Child* 2015;**0**:1–2.
doi:10.1136/archdischild-2014-307869

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*Arch Dis Child* published online February 4, 2015



## Notes