

## The evidence base for shaken baby syndrome

*We need to question the diagnostic criteria*

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The phrase “shaken baby syndrome” evokes a powerful image of abuse, in which a carer shakes a child sufficiently hard to produce whiplash forces that result in subdural and retinal bleeding. The theory of shaken baby syndrome rests on core assumptions: shaking is always intentional and violent; the injury an infant receives from shaking is invariably severe; and subdural and retinal bleeding is the result of criminal abuse, unless proved otherwise.<sup>1</sup> These beliefs are reinforced by an interpretation of the literature by medical experts, which may on occasion be instrumental in a carer being convicted or children being removed from their parents. But what is the evidence for the theory of shaken baby syndrome?

Retinal haemorrhage is one of the criteria used, and many doctors consider retinal haemorrhage with specific characteristics pathognomonic of shaking. However, in this issue Patrick Lantz et al examine that premise (p 754) and conclude that it “cannot be supported by objective scientific evidence.”<sup>2</sup> Their study comes hard on the heels of a recently published review of the literature on shaken baby syndrome from 1966 to 1998, in which Mark Donohoe found the scientific evidence to support a diagnosis of shaken baby syndrome to be much less reliable than generally thought.<sup>3</sup>

Shaken baby syndrome is usually diagnosed on the basis of subdural and retinal haemorrhages in an infant or young child,<sup>1</sup> although the diagnostic criteria are not uniform, and it is not unusual for the diagnosis to be based on subdural or retinal haemorrhages alone.<sup>4</sup> The website of the American Academy of Ophthalmology states that if the retinal haemorrhages have specific characteristics “shaking injury can be diagnosed with confidence regardless of other circumstances.”<sup>4</sup> Having reviewed the evidence base for the belief that perimacular folds with retinal haemorrhages are diagnostic of shaking, Lantz et al were able to find only two flawed case-control studies, much of the published work displaying “an absence of ... precise and reproducible case definition, and interpretations or conclusions that overstep the data.”<sup>2</sup> Their conclusions are remarkably similar to those of Donohoe, who found that “the evidence for shaken baby syndrome appears analogous to an inverted pyramid, with a very small database (most of it poor quality original research, retrospective in nature, and without appropriate control groups) spreading to a broad body of somewhat divergent opinions.”<sup>3</sup> His work entailed searching the literature, using the term “shaken baby syndrome” and then assessing the

methods of the articles retrieved, using the tools of evidence based inquiry. Reviewing the studies achieving the highest quality of evidence rating scores, Donohoe found that “there was inadequate scientific evidence to come to a firm conclusion on most aspects of causation, diagnosis, treatment, or any other matters,” and identified “serious data gaps, flaws of logic, inconsistency of case definition.”<sup>3</sup>

The conclusions of Lantz et al and of Donohoe make disturbing reading, because they reveal major shortcomings in the literature relating to a field in which the opportunity for scientific experimentation and controlled trials does not exist, but in which much may rest on interpretation of the medical evidence.<sup>5</sup>

If the concept of shaken baby syndrome is scientifically uncertain, we have a duty to re-examine the validity of other beliefs in the field of infant injury. The recent literature contains a number of publications that disprove traditional expert opinion in the field. A study of independently witnessed low level falls showed that such falls may prove fatal, causing both subdural and retinal bleeding.<sup>6</sup> <sup>7</sup> A biomechanical analysis validates that serious injury or death from a low level fall is possible and casts doubt on the idea that shaking can directly cause retinal or subdural haemorrhages.<sup>7</sup> <sup>8</sup> An important lucid interval may be present in an ultimately fatal head injury in an infant.<sup>8</sup> Neuropathological studies have shown that abused infants do not generally have severe traumatic brain injury and that the structural damage associated with death may be morphologically mild.<sup>9</sup> <sup>10</sup> What is the relevance of the craniocervical injuries to corticospinal tracts, dorsal nerve roots, and so on that have been described?<sup>10</sup> <sup>11</sup> We do not know. What is the force necessary to injure an infant’s brain? Again, we do not know.

While most abused children indisputably show the signs of violence, not all do. No one would be surprised to learn that a fall from a two storey building or involvement in a high speed road traffic crash can cause retinal and subdural bleeding, but what is the minimum force required? “It is one thing clearly to state that a certain quantum of force is necessary to produce a subdural hematoma; it is quite another to use examples of obviously extreme force ... and then suggest that they constitute the minimum force necessary.”<sup>12</sup>

Research in the area of injury to infants is difficult. Quality evidence may need to be based on finite element

modelling from data on infants' skulls, brains, and neck structures, rather than living animals. Any studies on immature animal models, if performed, will need to be validated against the known mechanical properties of the human infant. Pending completion of such studies, the reviews by Lantz and Donohoe are a valuable contribution and provide a salutary check for anyone wishing to cite the literature in support of an opinion. Their criticisms of lack of case definition or proper controls can be levelled at the whole literature on child abuse. If the issues are much less certain than we have been taught to believe, then to admit uncertainty sometimes would be appropriate for experts. Doing so may make prosecution more difficult, but a natural desire to protect children should not lead anyone to proffer opinions unsupported by good quality science. We need to reconsider the diagnostic criteria, if not the existence, of shaken baby syndrome.

J F Geddes *retired (formerly reader in clinical neuropathology, Queen Mary, University of London)*

London (j.f.geddes@doctors.org.uk)

J Plunkett *forensic pathologist*

Regina Medical Center, 1175 Nininger Road, Hastings, MN 55033, USA

Competing interests: JFG and JP have given evidence in criminal cases at the request of both the prosecution and the defence.

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## Shaken baby syndrome

*Pathological diagnosis rests on the combined triad, not on individual injuries*

Shaken baby syndrome is a form of physical non-accidental injury to infants, characterised by acute encephalopathy with subdural and retinal haemorrhages, occurring in a context of inappropriate or inconsistent history and commonly accompanied by other apparently inflicted injuries.<sup>1-3</sup> Injuries to the neck and spinal cord may also be present. Controversy surrounds the precise causation of the brain injury, the retinal and subdural haemorrhages, as well as the degree of force required and whether impact in addition to whiplash forces is needed.<sup>1-4</sup> Although most discussion has concerned fatal injuries of this nature, not all are lethal, but they may be associated with subsequent neurological disability of varying severity.

Expert medical evidence about inflicted injury must have scientific validity, but applying the evidence based criteria appropriate to clinical practice entails some difficulties.<sup>5</sup> In clinical practice medical management of defined clinical problems can be compared and best practice distinguished by clinical outcomes. Conversely, in inflicted paediatric injuries, one is presented with the outcome, investigation follows rather than precedes that outcome, and the history may be incomplete or deliberately misleading. A need exists for an impartial and intelligent assessment, but how may this be achieved in practice?

Because of the serious implications of diagnosing inflicted injury such as shaken baby syndrome, every case must be evaluated in detail, taking account of all the circumstances surrounding the injury and considering the pathological features in full, rather than attempting to evaluate the significance of each component.

In shaken baby syndrome, it is the combined triad of subdural and retinal haemorrhage with brain damage, as well as the characteristics of each of these components that allow a reconstruction of the mechanism of injury, and assessment of the degree of force employed. The application of rotational acceleration and deceleration forces to the infant's head causes the brain to rotate in the skull. Abrupt deceleration allows continuing brain rotation until bridging veins are stretched and ruptured, causing a thin layer of subdural haemorrhage on the surface of the brain. This is not a space occupying lesion; its importance is in indicating the mechanism of injury. The retinal haemorrhages, which are characteristically extensive, occupy much of the circumference of the globe and extend through all the layers of the retina and similarly result from rotational acceleration and deceleration forces.

The mechanism of brain damage is problematic. Traditional wisdom has suggested shearing forces operating within the brain substance with consequent axonal damage.<sup>6</sup> Geddes et al, in a careful neuropathological study of head injuries in children using  $\beta$  amyloid precursor protein immunostaining, observed that the predominant changes in infants with evidence of shaking were hypoxic-ischaemic rather than the diffuse axonal injury seen in older children and adults with fatal head trauma.<sup>7-8</sup> These authors thought that acceleration and deceleration forces might damage the neuraxis to cause apnoea, with consequent ischaemic insult causing diffuse cerebral oedema.

Unfortunately, this logical idea was followed in a second paper by the statement, "Although mechanisms of

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shaking must vary and nobody really knows how babies are injured, it may not be necessary to shake an infant very violently to produce stretch injury to its neuroaxis," a conclusion that is not supported by data in the paper and that has led to considerable controversy among expert witnesses in court.<sup>8</sup> It ignores the evidence for the force required to produce the triad of injuries, in fatal instances of shaken baby syndrome, obtained from evaluating the other components. Clearly, if "gentle" shaking were capable of causing fatal injury, such events would be an everyday occurrence. There is abundant evidence that minor head trauma, so common in the domestic context, is only very rarely associated with severe intracranial injury.<sup>9-11</sup>

Further confusion has been sown by a more recent contribution by Geddes et al.<sup>12</sup> This describes the neuropathological findings in the brains of infants dying of non-traumatic cerebral hypoxia. Random examination of sections of dura showed intradural haemorrhage evident only at the microscopic level. On this basis they thought that all the components normally indicative of shaken baby syndrome might result from hypoxic damage alone, dural and retinal haemorrhage being due to brain swelling consequent on cerebral hypoxia. However, subdural haemorrhage in shaken baby syndrome is a macroscopic, not a microscopic, finding, and the comment on retinal haemorrhage has even less foundation in that no examination of the eyes was made.

As shown by Lantz et al in this issue, even when a particular detail has been claimed to be pathognomonic of shaken baby syndrome, the diagnosis should not rest on this feature alone<sup>13</sup> (p 754). This careful case study reinforces the need for meticulous identification of the complexity of the injury and evaluating the findings against the validity of the explanation offered. It is also true that retinal haemorrhages can have causes other than shaking and that space occupying subdural haemorrhages causing death can occur in witnessed accidental injuries in children.<sup>14</sup> However, of the patients Plunkett described, the youngest was 12 months old, which is outside the age group in which most cases of shaken baby syndrome occur.<sup>14</sup>

The pathological diagnosis of shaken baby syndrome requires careful evaluation of the character and extent of all components of the injury and should

not rest merely on the presence or absence of one or more of the constituent lesions. The basic triad should have all the necessary features for confident diagnosis and the conclusion that undue force has been applied. Damage to the neck or spinal cord is further useful confirmation, and the presence of gripping injuries, while often absent, can provide further weight. Other inflicted extracranial injuries provide evidence of abuse even if they are not contemporaneous with the head injury.

Brian Harding *consultant neuropathologist*  
R Anthony Risdon *consultant paediatric pathologist*  
Great Ormond Street Hospital for Children, London WC1N 3JH

Henry F Krous *director of pathology*  
Children's Hospital San Diego, San Diego, CA 92123, USA

Competing interests: None declared.

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## Risk assessment for spinal injury after trauma

*The guidelines are simple and evidence based*

About 600-700 people sustain acute traumatic injuries to the spinal cord in the United Kingdom each year. Previously published data indicate that the injury to the spinal cord remains unrecognised in 4-9% of individuals.<sup>1,2</sup> Inadequate management of patients with injury to the spinal cord has the potential to lead to neurological deterioration, additional functional handicaps, and possibly medical litigation. Thousands of patients, however, routinely present to primary care centres every day with injuries to the neck and back. The immediate care and appropriate assessment of patients with spinal injury is a

skill that is expected of all doctors. General practitioners and hospital doctors with little or no training and experience of caring for patients with trauma might have to help the victims of a recent accident. They will certainly have to advise patients who complain of spinal pain after injury. This article is written to guide clinicians in these situations.

The evidence base for this subject has improved recently with some large scale studies from North America.<sup>3,4</sup> Several consensus guidelines have been published by the National Institute for Clinical Excellence and the British Trauma Society.<sup>5,6</sup> Most of

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*Am J Forensic Med Pathol* 2004;25 (in press).

# Letters

## The evidence base for shaken baby syndrome

### Response to editorial from 106 doctors

EDITOR—In challenging the diagnosis of shaken baby syndrome in their recent editorial Geddes and Plunkett make a number of serious errors in interpreting the research on this issue, and they display a worrisome and persistent bias against the diagnosis of child abuse in general.<sup>1</sup>

In their opening sentence Geddes and Plunkett describe shaking a child to “produce whiplash forces that result in subdural and retinal bleeding,” omitting the most important element in this condition: brain injury itself. They elaborate that the “theory” of shaken baby syndrome rests on some core assumptions, including that “the injury an infant receives from shaking is invariably severe.”

This is in conflict with the research of Alexander et al, Ewing-Cobbs et al, Kemp et al, and Jenny et al, who found that 30%-40% of newly diagnosed shaken baby cases had medical evidence of previously undiagnosed head injury.<sup>2-5</sup> These infants had such mild or non-specific symptoms and signs that their trauma was previously not diagnosed. The diagnosis was ultimately made when the children had subsequent severe episodes of abuse, with computer tomographic evidence of both acute and older subdural haematomata and brain injuries.

#### Retinal haemorrhages

Geddes and Plunkett then consider retinal haemorrhages. Lantz et al, in the same issue, question the specificity of perimacular folds in abusive head trauma in infancy.<sup>6</sup> They conclude from a literature review that there was no support for the contention that perimacular folds are pathognomonic for abusive head injury. Geddes and Plunkett applied these authors' conclusions not only to perimacular folds but also to retinal haemorrhages.

Although research on the subject of inflicted childhood neurotrauma—over 600 peer reviewed articles—does not claim that retinal haemorrhages are pathognomonic for abuse, it does show that retinal haemorrhages are, overwhelmingly, more common in abuse than in non-inflicted injury. When massive retinal haemorrhages

are seen in carefully studied children with non-inflicted major injuries, such as from motor vehicle crashes, crushing head injuries, as in Lantz et al's report, and falls from several storeys, child abuse is not a consideration.

One study analysed these obviously non-inflicted injuries and compared them with abusive head injuries in children under 6 years of age. Severe retinal haemorrhages were seen in 5 of the 233 (2%) children in the non-inflicted group and in 18 of the 54 (33%) in the abuse group.<sup>7</sup> Retinal pathology from major trauma mimicking shaken baby syndrome is old news.<sup>8-10</sup> Its incidence is dramatically lower than that resulting from inflicted head injury and because of the obvious major trauma history it does not present a diagnostic dilemma.

#### Literature on shaken baby syndrome

To discredit the literature on shaken baby syndrome over the past 30 years, Geddes and Plunkett rely on an article by Donohoe.<sup>11</sup> In so doing they have erred in their assessment of the status of the science in the field.

Donohoe's purpose was to examine trends in the quality of scientific evidence. Donohoe used evidence based medicine (EBM) criteria for weighting evidence to judge the comparative merit of published studies published before such criteria were widely embraced by authors, reviewers, and journals. He also plans to apply this process to more recently written articles. He explicitly did not challenge the existence of shaken baby syndrome and, to our knowledge, his review of more recent work has not yet been published. The cited paper reviewed studies published up to six years ago and purposely did not include research that has been published since that time.

One striking limitation of the Donohoe paper is that he used only the keywords “shaken baby syndrome” to search the literature whereas many of the articles on the subject use keywords such as “inflicted childhood neurotrauma,” “childhood head injury,” “cranio-cerebral trauma,” “inflicted traumatic brain injury,” as well as several others. We know of a number of qualified

studies that were not included. If the search had been appropriately more inclusive, the resulting conclusions would likely have been quite different.

The application of EBM criteria to judge articles is intended to help physicians discern truth among competing works. The absence of clinical trials and definitive population based studies means lower EBM scores when the work is compared with more definitive work. Low EBM scores, in the absence of more highly regarded work, do not mean that the work is wrong, only that there is room for further research to learn more and that prior conclusions may not be definitive. Many aspects of clinical practice and medical knowledge have not been established with certainty by EBM criteria.

The comparative paucity of well-done population based cohort studies, in the face of a rather large literature of case reports, case series, cohort studies, and case-control studies underscores how hard research in this area is to complete. It also emphasises the need for more research and more government research assistance. Child abuse is a particularly difficult area in which to conduct research. Issues of informed consent, inadequacy of animal models, and the potential legal consequences of participation and telling the truth make this a complicated field.

#### Short falls in childhood

Geddes and Plunkett claim that “the recent literature contains a number of publications that disprove traditional expert opinion in the field” about short falls in childhood. However, they cite only two publications, and neither disproves the evidence presented in over 25 other studies of short falls in infancy and childhood.

Plunkett cites his own article on fatal falls from short distances in playgrounds, using archived data from various sources.<sup>12</sup> His study has significant problems: the determination of the distances of the falls in the 75 000 cases presented relies on information supplied by the original sources of data and is thus open to question; no infants were studied; several of the falls were from 7 feet (that is, they were not “short” falls); several of the children had crush injuries or pre-existing conditions; and none of the children had “formal retinal evaluation.” Nevertheless, Plunkett and others assert that this study “proves” that short falls can kill and cause retinal haemorrhages.

Contact subdural and epidural haemorrhages may, however, result from short falls.<sup>10</sup> They can occasionally cause severe



illness or death from space occupying lesions. Occasionally children with contact injuries due to short falls develop malignant cerebral oedema. Plunkett's fatal cases seem to fall into these categories, as opposed to the whiplash brain injuries associated with immediate concussions seen with severe inflicted head injuries.<sup>w2</sup> Even if one were to accept his conclusions despite these methodological flaws, the study found that death from short falls was still exceedingly rare (18/75 000 = 0.02%). The only other article cited is a review by Ommaya et al that provides no new data and makes sweeping editorial observations unjustified by the literature cited.<sup>w3</sup>

#### Biomechanical studies

Geddes and Plunkett end by dismissing animal model studies unless they are "validated against the known mechanical properties of the human infant." How are these properties to be known? How can an investigator measure the tensile strength of the *living* infant dura, skull, bridging veins, cerebral cortex, and neck musculature? Although more appropriate studies of the mechanical properties of infant animal brain are beginning to be done,<sup>w4-w7</sup> no current studies reflect the response of infant animal brain tissue to harmonic forces, such as those likely occurring with infant shaking. Although more biologically faithful mechanical models of infants are being constructed,<sup>w8-w9</sup> they will still only approach the response of living infants to shaking.

Asserting that shaking cannot cause infant brain injury, on the basis of current biomechanical studies is premature. Juxtaposed with these mechanical approximations, there is extensive clinical experience and an emerging literature of confessed shaking causing brain injury in infants.<sup>w10</sup>

#### Conclusion

Child abuse is an enormous social, medical, and mental health problem and its evaluation and treatment have far-reaching implications for children, families, and society. To provide optimal diagnosis and treatment, careful objective research and intellectual honesty are needed and must prevail over the entrenchment of ideological schools of thought and "winning" in court. Unfortunately, there remains considerable difficulty for some doctors to accept that children are abused. We must look at these cases using all of the information available, including collected clinical experience and the synthesis of the best literature on the subject.<sup>w11</sup>

**Robert M Reece** *clinical professor of paediatrics*  
PO Box 523, 122 Hawk Pine Road, Norwich, VT  
05055, USA  
[rmreece1.aol.com](mailto:rmreece1.aol.com)

This letter is signed by another 105 doctors (see [bmj.com](http://bmj.com) for details).

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**P+** Details of the other 105 signatories are available on [bmj.com](http://bmj.com), as are details of references w1-w11

#### Authors' reply

EDITOR—It is difficult to understand how Reece et al could interpret our editorial as displaying "a worrisome and persistent bias against the diagnosis of child abuse in general." Child abuse exists, and we know and attest that it exists. The editorial does not discuss "child abuse in general."

Child abuse exists in many forms: our editorial addresses the diagnostic criteria for a specific type of abuse, the so-called shaken baby syndrome. We emphasise, as have Donohoe and Lantz et al,<sup>1,2</sup> that the literature to support a diagnosis of shaken baby syndrome/inflicted head injury is based on imprecise and ill-defined criteria, biased selection, circular reasoning, inappropriate controls, and conclusions that overstep the data. If it is the questioning of the criteria that is worrisome, we will continue to do so and to cause worry.

We encouraged the readers to evaluate critically the evidentiary basis for a diagnosis of shaken baby syndrome in the light of the questions raised by the two papers. Of course Donohoe's study was limited and would retrieve only papers that included the words "shaken baby syndrome" in the title, key words, or abstract. The lack of scientific rigour that he identified is not restricted to infant head injury papers that specifically mention shaken baby syndrome. If Reece et al perform a critical review of the "number of qualified studies" that they assert would have been included by a wider search, they will encounter the same "data gaps, flaws of logic, and inconsistency of case definition" that were present in the literature studied by Donohoe. We would urge them to look again, for example, at the paper they cite by Alexander et al, where they will find all the above shortcomings.<sup>3</sup>

Finally, we are at a loss to explain or accept the authors' statement in their penultimate sentence: "Unfortunately, there remains considerable difficulty for some doctors to accept that children are abused."

If the authors are suggesting that we are among those doctors, or are encouraging others to be so, their argument is a willful misinterpretation of what we have written. When there is new evidence that challenges an established conviction, medicine has the responsibility to critically evaluate the data, and if verifiable, reflect that change. We must have no vested interest in yesterday's belief. We are encouraging doctors to think clearly and critically, even in an area as emotive as child abuse. No more. And no less.

**J F Geddes** *retired (formerly reader in clinical neuropathology, Queen Mary, University of London)*  
London  
[j.f.geddes@doctors.org.uk](mailto:j.f.geddes@doctors.org.uk)

**J Plunkett** *forensic pathologist*  
Regina Medical Center, 1175 Nininger Road,  
Hastings, MN 55033, USA

Competing interests: JFG and JP have given evidence in criminal cases at the request of both the prosecution and the defence.

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**P+** A full version of this letter is available on [bmj.com](http://bmj.com)

#### Doctors' communication of trust, care, and respect

##### Details of paper were incorrect

EDITOR—Burkitt Wright et al have not attended one of my group's communication skills courses; yet that doesn't stop them from saying that patients valued forms of communication that are currently not emphasised in training and research, and did not intrinsically value others that are currently thought important, including provision of information and choice.<sup>1</sup> Apart from the breathtakingly absurd suggestion that a qualitative analysis of views of 39 women with breast cancer should overturn painstaking research and survey findings gathered by many, their assertions are factually incorrect.

Firstly, we always ensure that patient needs inform the content of communication skills courses by involving patient groups and considering empirical research findings.

Secondly, patient centredness is a core component of our courses, which includes learning how to tailor information giving, providing choice if wanted, responding appropriately to patient led cues, and expressing empathy and respect.

Thirdly, each day CancerBACUP receives many calls from distressed patients and relatives made anxious and distraught by the lack of information they have received. We need trust, care, and respect, but no convincing evidence exists to show that those things in themselves are enough.

I am indignant that our work and that that of others whom I respect receives such

*Details of the other 105 signatories*

Randell C. Alexander, M.D., Ph.D.  
Professor of Pediatrics, Morehouse School of Medicine  
Atlanta, Georgia

Howard Dubowitz, M.D.  
Professor of Pediatrics  
University of Maryland School of Medicine

Kenneth W. Feldman, MD  
Clinical Professor  
The University of Washington School of Medicine

David L. Kerns, MD  
Adjunct Clinical Professor of Pediatrics  
Sanford University School of Medicine

John M. Leventhal, M.D.  
Professor of Pediatrics  
Yale University School of Medicine

Alex V. Levin, M.D., MHSc, FRCSC  
Associate Professor of Pediatrics and Ophthalmology  
The Hospital for Sick Children, University of Toronto

Desmond K. Runyan, MD, Dr PH  
Professor and Chair of Social Medicine  
University of North Carolina School of Medicine

John Ross Ainsworth  
Paediatric Ophthalmology  
Birmingham Children's Hospital  
Honorary Senior Lecturer, University of Birmingham

Seth Asser, M.D.  
Medical Consultant  
Children's Healthcare Is a Legal Duty, Inc.

Ronald G. Barr, MDCM, FRCPC  
Canada Research Chair in Community Child Health Research  
Vancouver, British Columbia, Canada

Amy Baxter, M.D.  
Children's Medical Center at Dallas

Kirsten Bechtel, M.D.  
Assistant Professor of Pediatrics  
Yale University School of Medicine

Susan Bennett M.B. Ch.B. FRCP  
Assistant Professor  
University of Ottawa Departments of Pediatrics and Psychiatry

Scott Benton, M.D.  
Clinical Associate Professor of Pediatrics  
LSU and Tulane Departments of Pediatrics

Rachel Berger MD, MPH  
Assistant Professor of Pediatrics  
University of Pittsburgh School of Medicine

Robert Block, M.D.  
Professor and Chair, Department of Pediatrics  
University of Oklahoma School of Medicine, Tulsa Campus

Lucilla Butler MA FRCOphth FRCSEd  
Consultant Ophthalmologist  
Birmingham and Midland Eye Centre, City Hospital, Birmingham UK

David L. Chadwick, M.D.  
Research Professor  
University of Utah

David L. Corwin, M.D.  
Professor and Chief, Division of Child Protection and Family Health Pediatrics Department  
University of Utah  
Salt Lake City, Utah

Jack Coyne M.D.  
Clinical Associate Professor of Pediatrics  
State University of New York at Buffalo

Margaret Crawford  
Consultant Paediatrician  
United Lincolnshire Hospitals Trust

Holly W. Davis, M.D.  
Associate Professor of Pediatrics  
University of Pittsburgh Medical Center

Geoffrey DeBelle, MB, BS, FRACP, FRCPCH, DRCOG  
Consultant Paediatrician (Community Child Health)  
Named Doctor (Child Protection)  
Birmingham Children's Hospital, Birmingham, UK.

Julia DeBellis, MD  
The Joseph M. Sanzari Children's Hospital at Hackensack University Medical Center  
University of Medicine and Dentistry of New Jersey

Marcus DeGraw, M.D.  
St. John Health System

Allan R. De Jong, MD  
Clinical Professor of Pediatrics  
Jefferson Medical College of Thomas Jefferson University

Mark S. Dias, MD  
Associate Professor of Neurosurgery, Chief of Pediatric Neurosurgery  
Milton S. Hershey Medical Center

Michael Durfee, M.D.  
Chief Consultant  
ICAN National Center for Child Fatality Review

Anna Ells, MD, FRCS (C)  
Pediatric Ophthalmologist, Alberta Children's Hospital,  
Calgary, Alberta, Canada.

Martin A. Finkel, D.O., FACOP, FAAP  
Professor of Pediatrics  
University of Medicine and Dentistry of New Jersey

Howard Fischer MD  
Associate Professor of Pediatrics  
Wayne State University School of Medicine

Emalee Flaherty, MD.  
Assistant Professor of Pediatrics  
Northwestern University School of Medicine, Chicago, IL

Brian J Forbes M.D.,Ph.D  
Dept of Ophthalmology  
The Children's Hospital of Philadelphia

Gilles Fortin, MD  
Associate Clinical Professor Pediatrics  
Montreal University

Lori Frasier, M.D.  
Associate Professor of Pediatrics  
University of Utah School of Medicine

W. David Gemmill, MD.  
Toledo, Ohio

MGF Gilliland MD  
Professor, Brody School of Medicine at East Carolina University  
Department of Pathology and Laboratory Medicine, Forensic Division

Gwendolyn Gladstone, MD  
Clinical Instructor in Pediatrics, Harvard Medical School  
Adjunct Assistant Professor of Pediatrics, Dartmouth Medical School

Dr Danya Glaser  
Consultant Child & Adolescent Psychiatrist and Named Doctor for Child Protection  
Great Ormond Street Hospital for Children  
London, England

Jill Glick, M.D.  
Associate Professor of Pediatrics  
University of Chicago

Penny Grant, M.D.  
Assistant Professor of Pediatrics  
University of Oklahoma School of Medicine

Bruce Herman, MD.  
Associate Professor of Pediatrics  
University of Utah School of Medicine

Astrid Heppenstall Heger, M.D.  
Keck School of Medicine  
University of Southern California

Ralph A. Hicks, MD  
Associate Professor of Pediatrics  
Wright State University Department of Pediatrics

Dr Chris Hobbs  
Consultant Paediatrician  
St James's University Hospital  
Leeds, United Kingdom

Philip Hyden, MD, JD  
Associate Clinical Professor of Pediatrics  
Weill Medical College of Cornell University

Kent Hymel, M.D.  
Associate Clinical Professor of Pediatrics  
University of Virginia

Carole Jenny, MD, MBA  
Professor of Pediatrics  
Brown Medical School

Richard Kaplan, MD, MSW  
Clinical Associate Professor of Pediatrics  
University of Minnesota School of Medicine

Jerry G. Jones, M.D.  
Professor of Pediatrics  
University of Arkansas

Alison Kemp  
Senior Lecturer Child Health  
University of Wales College of Medicine, Cardiff. S Wales UK

Steven Kairys, MD, MPH  
Chairman of Pediatrics  
Jersey Shore University Medical Center

Marilyn Kaufhold, MD  
Children's Hospital, San Diego

Nancy Kellogg, M.D.  
Professor of Pediatrics  
University of Texas Health Science Center at San Antonio

Paul K. Kleinman, M.D.  
Professor of Radiology  
Harvard Medical School

Henry F. Krous, M.D.  
Professor of Pathology and Pediatrics  
Children's Hospital of San Diego, University of California, San Diego School of Medicine

Richard D. Krugman, M.D.  
Professor of Pediatrics and Dean  
University of Colorado School of Medicine

Cynthia L. Kuelbs, MD  
Medical Director, Chadwick Center for Children and Families  
Children's Hospital, San Diego

Wendy G. Lane, M.D., MPH  
Department of Epidemiology and Preventive Medicine  
University of Maryland School of Medicine

Dr Vic Larcher  
Consultant Paediatrician and Named Doctor for Child Protection  
Queen Elizabeth Children's Service, The Royal London Hospital

Stephen Lazowitz, M.D.  
Vice-President – Medical Affairs  
Children's Hospital, Omaha Nebraska

Lori Legano, M.D.  
Assistant Professor of Clinical Pediatrics  
New York University School of Medicine

Carolyn J. Levitt, M.D.  
Asst. Professor of Pediatrics  
University of Minnesota

Richard Alan Lewis M.D., M.S.  
Professor, Departments of Ophthalmology, Medicine, Pediatrics, and Molecular and Human Genetics  
Baylor College of Medicine

Michelle Lorand, M.D.  
Assistant Professor of Pediatrics  
Chicago Medical School

Deborah Lowen, MD  
Assistant Professor of Pediatrics  
University of Oklahoma College of Medicine - Tulsa

James L. Lukefahr, MD  
Professor of Pediatrics  
University of Texas Medical Branch

Professor Margaret Lynch  
Newcomen Centre, Guy's Hospital  
London, UK

Margaret McHugh, M.D., MPH  
Clinical Associate Professor of Pediatrics  
NYU School of Medicine

Eedy Mezer, M.D.  
Staff Pediatric Ophthalmologist  
Rambam Medical Center, Haifa, Israel

Marcellina Mian, M.D.  
Professor of Paediatrics  
University of Toronto

Dr Jacqueline Mok  
Consultant Paediatrician  
Royal Hospital for Sick Children, Edinburgh

Dr Alan Mulvihill, FRCSI.  
Consultant Ophthalmic Surgeon  
Princess Alexandra Eye Pavilion, Edinburgh

Robert Nelken, M.D.  
Andover Pediatrics, Andover Massachusetts

Eli Newberger, M.D.  
Assistant Professor of Pediatrics  
Harvard Medical School

R. Kim Oates, MD  
Professor of Paediatrics and Child Health, the University of Sydney  
Chief Executive, The Children's Hospital at Westmead, Sydney, Australia

Vincent J. Palusci, MD, MS  
Associate Professor of Pediatrics & Human Development  
Michigan State University School of Medicine

Dr Jean Price  
Designated Doctor  
Southampton Community Primary Care Trust

Judson B. Reaney, MD  
Instructor of Pediatrics  
University of Minnesota

Lawrence Ricci, M.D.  
Assistant Professor of Pediatrics  
University of Vermont

John D. Roarty, MD  
Children's Hospital of Michigan  
Detroit, Michigan

Karen St. Claire, MD  
Clinical Assistant Professor, Department of Pediatrics  
Duke University Medical Center

D. Rosenberg, M.D.  
Assistant Professor of Pediatrics  
University of Colorado School of Medicine

Martin Samuels  
Senior Lecturer in Paediatrics  
Keele University / University Hospital of North Staffordshire

Robert Sege, M.D., PhD  
Associate Professor of Pediatrics  
Tufts University School of Medicine, Boston MA

Randall Schlievert, MD  
Director, Child Maltreatment Program  
Mercy Children's Hospital, Toledo, Ohio

Susan Schloff, MD  
Pediatric Ophthalmology  
St. Paul, Minnesota

Sara E. Schuh MD, MPH  
Associate Professor of Pediatrics  
Medical University of South Carolina

Dr Neela Shabde  
Consultant Paediatrician  
Northumbria Healthcare NHS Trust, North Tyneside General Hospital  
North Shields UK

Lynn K. Sheets, M.D.  
Kansas University Children's Center

Jo Sibert  
Professor of Child Health  
University of Wales College of Medicine

Andrew Sirotnak, M.D.  
Associate Professor of Pediatrics  
University of Colorado School of Medicine

Professor David Southall OBE, FRCPCH, MD  
Consultant Paediatrician, University Hospital of North Staffordshire  
Staffordshire UK

Betty S. Spivack, MD  
Assistant Clinical Professor of Pediatrics and Pathology  
University of Louisville School of Medicine

Janet Squires M.D.  
Professor of Pediatrics  
University of Pittsburgh Medical Center, Children's Hospital of Pittsburgh

Suzanne P. Starling, MD  
Associate Professor of Pediatrics  
Eastern Virginia Medical School

R. Daryl Steiner, D.O.  
Assistant Professor of Clinical Pediatrics  
Northeastern Ohio Universities College of Medicine

John Stirling, M.D.  
Vancouver Pediatrics, Vancouver, Washington

Wilbur L Smith MD  
Professor and Chairman, Department of Radiology  
Wayne State University

Naomi F. Sugar MD  
Clinical Associate Professor of Pediatrics  
University of Washington School of Medicine

Nasrin Najm Tehrani MBCh, MSc, FRCS Ed (Ophth)  
Clinical Associate Staff Ophthalmologist  
The Hospital for Sick Children, Toronto, Canada

Linda R. Thompson M.B., B.S.  
Assistant Professor Department of Pediatrics  
University of Minnesota

Kathryn Wells, M.D.  
Instructor in Pediatrics  
University of Colorado Health Sciences Center

James J. Williams, MD

Tamara Wygnanski-Jaffe M.D.  
Pediatric Ophthalmologist  
Goldschleger Eye Institute, Sheba Medical Center, Israel.

Competing interests: None declared.

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## Evidence based case report

# Perimacular retinal folds from childhood head trauma

P E Lantz, S H Sinal, C A Stanton, R G Weaver Jr

Editorials by Geddes and Plunkett and Harding et al

Department of Pathology, Wake Forest University School of Medicine, Winston-Salem, NC 27157, USA

P E Lantz  
associate professor  
C A Stanton  
associate professor

Department of Paediatrics, Wake Forest University School of Medicine  
S H Sinal  
professor

Department of Ophthalmology, Wake Forest University School of Medicine

R G Weaver Jr  
associate professor

Correspondence to: P E Lantz plantz@wfubmc.edu

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A previously healthy 14 month old child was transferred to our medical centre with a severe head injury. The father had collected the boy and his 3 year old brother from their mother at his workplace car park and taken them home while their mother went to work. The children had been watching television while the father prepared dinner. After hearing something fall, the father found the boy on the floor with the television covering the right side of the head and anterior chest. A homemade television stand was partially across the child's lower legs. His older brother stated, "television fell." As soon as the father removed the television, he noticed the child's head beginning to swell. A neighbour drove them to the local hospital. According to the father and the neighbour, the child never stopped breathing and no resuscitative efforts were attempted.

Cranial computed tomography showed extensive head injuries. He had soft tissue swelling of the scalp, diffuse cerebral oedema with a subdural haematoma overlying the frontal convexities and layering along the falx cerebri, a left sided skull fracture adjacent to a widely diastatic coronal suture, cerebral contusions beneath the fracture, and a rightward midline shift measuring 8 mm. The paediatric ophthalmologist described bilateral dot and blot intraretinal haemorrhages, preretinal haemorrhages, and perimacular retinal folds (fig 1).

The child's condition deteriorated, and he died 18 hours after the incident. Child Protective Services removed the 3 year old sibling from the home because the retinal haemorrhages and retinal folds were considered diagnostic of abusive head trauma from shaking. This action was taken despite the father's repeated detailed, consistent account provided to emergency staff, the paediatric child abuse specialist, paediatric intensive care doctors, and law enforcement authorities.

## Postmortem evidence

A forensic autopsy showed no direct trauma to the orbits or eyes. There were prominent bilateral scalp contusions with soft tissue and intramuscular haemorrhage, symmetrical parietal skull fractures with coronal sutural diastasis, and a lacerated dura mater with extrusion of brain and blood. In addition to bilateral subdural and subarachnoid haemorrhages, a thin epidural haematoma partially covered the frontoparietal, calvarial lamina interna. The brain showed bilateral cortical contusions, severe cerebral oedema, and diffuse anoxic-ischemic injury. Postmortem ocular examination showed haemorrhages of the optic nerve sheaths with subdural haemorrhage greater than subarachnoid haemorrhage. Both eyes had extensive retinal haemorrhages with perimacular retinal folds (fig 2). Retinoschisis and peripapillary intrascleral haemorrhages were evident, and the retinal haemorrhages extended from the posterior pole to the ora serrata affecting the preretinal, intraretinal, and subretinal layers.

When investigators went to the house to recover the television before the family returned home, it was still on the carpeted floor. The 480 mm screen television with built in videocassette recorder weighed 19.5 kg. The homemade television stand measured 762 mm (height)×635 mm (width)×508 mm (depth) and had a bottom drawer that held videotapes. A greasy smudged area on the glass of the television corresponded with the impact site on the child's head.

A re-enactment in which a 11.4 kg weight (similar to the child's weight at autopsy of 11.8 kg) was placed on the partially opened drawer caused the television and



Details of the included studies are on [bmj.com](http://bmj.com)

television stand to readily topple forward. According to investigators, the family home was 7.8 km from the workplace and about 6 km from the local hospital. Based on the distance and estimated driving times plus workplace time clock records, the father was home with the children about 20 minutes when the incident happened. The day after the incident, while in foster care, the 3 year old sibling corroborated the father's account. Despite all this evidence, the paediatric ophthalmologist repeated that perimacular retinal folds coincident with retinal haemorrhages were considered specific for shaken baby syndrome secondary to retinal traction exerted by the oscillating vitreous.

### Search for published evidence

We were unable to find a published report of perimacular retinal folds in a childhood non-abusive head injury. We therefore did a systematic review of the medical literature on perimacular retinal folds associated with abusive head trauma in infants and young children. Our background question became: "In infants and young children with an acute intracranial injury, are perimacular retinal folds specific for head injury from vitreoretinal traction occurring during cycles of acceleration and deceleration (shaken baby syndrome)?"

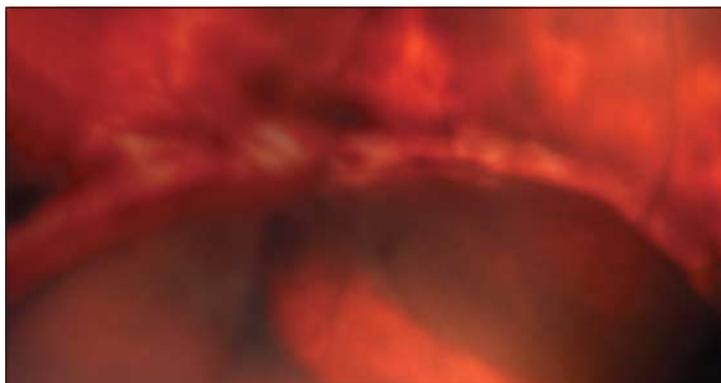
We searched the Medline (1966-2003) database using the terms retinal folds and child abuse and uncovered seven non-comparative case series articles.<sup>1-7</sup> We also examined references cited in these articles plus review articles and book chapters on ocular findings in child abuse mentioning or discussing perimacular retinal folds relative to non-accidental head injury. Similar searches in the Cochrane Library, ISI Web of Science, and Ovid found no additional articles.

### Results

We found 42 articles and book chapters discussing perimacular retinal folds in childhood abusive head trauma. Seventeen mentioned the presence of retinal folds in non-accidental head injury but did not comment on specificity or formative mechanism. A table on [bmj.com](http://bmj.com) gives details of the remaining articles. All but two of the articles are non-comparative clinical or autopsy case series, case reports, review articles, or book chapters.

The two studies that included controls both showed bias in selection of controls and contained no cases with perimacular retinal folds but discussed the postulated causal mechanism.<sup>8,9</sup> In the prospective controlled study, the authors reported on 79 children younger than 3 years who had sustained head injuries.<sup>8</sup> The manner of injury in one case was indeterminate. Three children, including one who died, had non-accidental head injury diagnosed, all of whom had retinal haemorrhages; 72 of the 75 children with non-abusive injuries were managed by observation alone. No perimacular retinal folds were observed; however, the presumed causative mechanism of traumatic retinoschisis and retinal folds was discussed.

The second controlled study was a prospective autopsy study that examined the presence and location of ocular findings in 169 childhood deaths.<sup>9</sup> Ocular haemorrhages (retinal, peripheral retinal, optic nerve sheath and intrascleral) were more likely in craniocer-



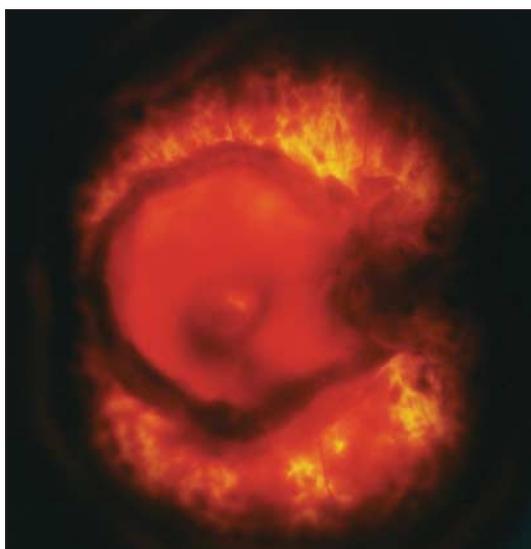
**Fig 1** Clinical image highlighting temporal portion of perimacular retinal fold at 2-3 o'clock area in left eye with a blood vessel bending over the fold (magnification  $\times 6$ )

bral trauma than in non-head injuries and natural diseases. Although case selection was purportedly random, the study contained a disproportionately high number of deaths from child abuse compared with natural and non-abusive causes. Case selection depended on the pathologist's willingness to participate in the study, and we were told by one of the authors that pathologists were more willing to participate when they believed that the deaths were abusive or suspicious (M Gilliland, personal communication, 2002). Perimacular retinal folds were not noted, but the authors concluded that acceleration-deceleration injury to the retina accounts for peripheral retinal haemorrhages and retinal folds.

### Supporting evidence

The references cited to support statements about the specificity or causal mechanism of perimacular retinal folds and abusive head injury in the articles we found are all non-comparative observational reports, unsystematic review articles, and book chapters. Seventy per cent of the articles cited four non-comparative case series.<sup>1,2,3,10</sup> We assessed the quality of this evidence.

Gaynon et al reported on two infants with presumed shaken baby syndrome who had retinal folds and concluded that these folds may be a hallmark



**Fig 2** Transilluminated retinal image of right eye at autopsy showing circinate, elevated, perimacular retinal fold and extensive retinal haemorrhages

of shaking injuries in child abuse victims.<sup>1</sup> One infant reportedly fell 1.5 m to the floor while being carried down a stairway.

Massicotte et al reported the ocular findings at autopsy of three children with perimacular retinal folds.<sup>2</sup> Two infants had sustained direct head trauma, but in the other there was no physical or forensic evidence of direct head trauma. They observed that the vitreous had partially separated from the retina but remained attached to the internal limiting membrane at the apices of the folds and the vitreous base. They concluded that their study confirmed the role of vitreous traction in formation of perimacular folds and proved that shaking alone caused these folds and shaking was never an accidental phenomenon.

Elner et al reviewed the ocular and autopsy findings in 10 consecutive children who died of suspected child abuse.<sup>3</sup> Perimacular retinal folds were observed in three children, all of whom had evidence of blunt head injuries.

Greenwald et al reported five cases of children in whom definite or probable physical abuse during infancy was associated with traumatic retinoschisis.<sup>10</sup> They hypothesised that when an infant is shaken, the head is subjected to repetitive accelerations and decelerations causing the relatively dense lens to move forward and back within the ocular fluids. Transmission of force through firm attachments between the lens, vitreous gel, and particularly the macular retina presumably would result in appreciable traction on the retina causing it to split and creating the surrounding folds.

## Discussion

Statements in the medical literature that perimacular retinal folds are diagnostic of shaken baby syndrome are not supported by objective scientific evidence. Non-comparative observational reports and unsystematic narrative review articles contain insufficient evidence to provide unbiased support for or against diagnostic specificity, and inferences about associations, causal or otherwise, cannot be determined. Clinical and autopsy evidence of ocular lesions must therefore be considered alongside other physical findings and a thorough investigation before concluding whether a head injury is caused by abuse. The child in our case had ocular haemorrhages (peripheral retinal, optic nerve sheath and intrascleral) and retinoschisis, which again some people consider specific for child abuse. Unfortunately, the evidence for these assumptions has similar problems to

that for perimacular retinal folds. An evidence based analysis of indexed medical publications on shaken baby syndrome from 1966-1998 uncovered a weak scientific evidence base.<sup>11</sup> Selection bias, inappropriate controls, and the lack of precise criteria for case definition were identified as important problems with the data. Many studies committed a fallacy of assumption, selecting cases by the presence of the clinical findings that were sought as diagnostically valid. Unsystematic reviews and consensus statements often mingled opinion with facts and added no original supporting evidence.

Perimacular retinal folds are associated with increased neurological morbidity and mortality in infants and children with abusive head injuries.<sup>6</sup> The reported incidence of perimacular retinal folds in shaken baby syndrome varies from 6% in a consecutive clinical case series to 50% in a sequential autopsy case series.<sup>5,12</sup> Clinical and autopsy studies with appropriately matched controls are needed to determine the causal mechanism of perimacular retinal folds and their specificity for abusive head injury. Until good evidence is available, we urge caution in interpreting eye findings out of context.

Contributors: PEL conceived the idea, collected the articles, and wrote the initial draft. All authors contributed to the review process, writing, and final editing of the paper. PEL is the guarantor. Competing interests: None declared.

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(Accepted 28 January 2004)

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### Table

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## Table

Articles referring to diagnostic specificity or causal mechanism of perimacular retinal folds (PRF) in childhood non-accidental head injury

Reference	Publication date	Study type (No of cases)	Reference(s) cited re PRF
Gaynon MW et al <sup>1</sup>	1988	Clinical case series (2; 2 with PRF)	Case series <sup>10</sup>
Han DP et al. <sup>4</sup>	1990	Clinical case series (6; 2 with PRF)	Case series, <sup>1</sup> Abstract <sup>w18*</sup>
Greenwald MJ <sup>w1</sup>	1990	Review article	Case series <sup>1;3;10</sup> Case report <sup>w19</sup> Abstract <sup>w18</sup>
Massicotte SJ et al <sup>2</sup>	1991	Autopsy case series (3; 3 with PRF)	Case series <sup>1;3</sup>
Kaur B et al <sup>w2</sup>	1992	Review article	Case series <sup>1;2</sup>

Buyts YM et al <sup>8</sup>	1992	Prospective clinical study; 0 with PRF	Case series <sup>1;2</sup>
Munger CE et al <sup>7</sup>	1993	Autopsy case series (12; 5 with PRF)	Case series <sup>1;10</sup>
Keithahn MAZ et a. <sup>w3</sup>	1993	Clinical adult case series (2; 2 with PRF)	Case series <sup>1;2;3</sup>
AAP Committee on Child Abuse & Neglect <sup>w4</sup>	1993	Position paper – Review article	Case series <sup>10</sup> Review article <sup>w12</sup>
Gilliland MGF et al <sup>9</sup>	1994	Prospective autopsy study; 0 with PRF	Case series <sup>1;2;7</sup>
Meier P et al <sup>w5</sup>	1996	Clinical case series (2; 2 with PRF)	Case series <sup>1;2;w3</sup>
Andrews AP et al <sup>w6</sup>	1996	Review article	Case series <sup>1;2</sup>
Rohrbach JM et al <sup>w7</sup>	1997	Autopsy case report	Case series <sup>1;2;3;10</sup>
Ellis PS <sup>w8</sup>	1997	Review article	Case series <sup>1;2</sup>
Mills M <sup>6</sup>	1998	Clinical case series (10; 4 with PRF)	Case series <sup>1;2</sup>
Drack AV et al <sup>w20</sup>	1999	Clinical case series (4; 1 with PRF)	Case series <sup>1;2</sup>
Ophthalmology Child Abuse Working Group <sup>w9</sup>	1999	Consensus review article	Case series <sup>1;2;3;7</sup>
Levin AV <sup>w10</sup>	2000	Book chapter	Case series <sup>1;2;6</sup>
Taylor D <sup>w11</sup>	2000	Review article	Case report <sup>w7</sup> Case series <sup>1;2;3;7</sup>
Levin AV <sup>w22</sup>	2001	Book chapter	Case series <sup>10</sup> Book chapter <sup>w10</sup>
Kivlin JD <sup>w21</sup>	2001	Review article	Case series <sup>1;2;6</sup> Review article <sup>w1;11</sup>
AAP Committee on Child Abuse & Neglect <sup>w13</sup>	2001	Technical report – review article	Case series <sup>10</sup> Review article <sup>w12</sup>

			Book chapter <sup>w10</sup>
Nadel FM et al <sup>w14</sup>	2001	Case report; 0 with PRF	Case series <sup>w15</sup>  Review article <sup>w12;w16</sup>
Marshall DH et al <sup>5</sup>	2001	Autopsy case series (6; 3 with PRF)	Case series <sup>1;2</sup>  Review article <sup>11</sup>
Levin AV <sup>w17</sup>	2002	Review article	Case series <sup>2</sup>

PRF = perimacular retinal fold.

\*Reference w18 could not be verified as cited.

## Patterns of presentation of the shaken baby syndrome

See Editorials pp 719, 720, and *Clinical review* p 754

### Four types of inflicted brain injury predominate

**EDITOR**—One of the controversies that has recently arisen in cases of alleged shaken baby syndrome concerns the disparity between certain neuropathological findings at necropsy and whether these findings are consistent with the entity regarded as the shaken baby syndrome.

A database was collected for more than five years of documented Scottish cases of suspected non-accidental head injury diagnosed after a multiagency assessment and including cases with uncoerced confessions of perpetrators and criminal convictions. Several patterns of presentation allow delineation of cases into four predominant types.

#### *Hyperacute encephalopathy (cervicomedullary syndrome)*

This hyperacute encephalopathy (6% of all cases) results from extreme “whiplashing” forces, the infant suffering the equivalent of a broken neck or, more correctly, a broken brain stem. In infants with a median survival of one day Geddes et al described localised axonal damage at the craniocervical junction, in the corticospinal tracts, and in the cervical cord roots, consistent with hyperflexion and hyperextension movements.<sup>1</sup> These cases, which truly reflect a “whiplash” shaking injury to the stem, are infrequently seen by clinicians because the patients are either dead on admission or die shortly thereafter.

Presentation is at 2-3 months of age, with acute respiratory failure (direct medullary trauma) and cerebral oedema (a “black brain” on imaging). At necropsy these infants have severe brain swelling and hypoxic injury but little axonal shearing and only a thin (trivial) subdural haemorrhage. Such presentations could result from a primary injury to the brain stem, induced by hyperflexion and hyperextension, or, rarely, from traumatic thrombosis of the vertebral arteries in the foramina of the cervical vertebrae.

#### *Acute encephalopathy*

An acute encephalopathic presentation (53% of cases) is characterised by a depressed conscious state, raised intracranial pressure, fits, apnoea, hypotonia or decerebration, anaemia, shock, bilateral subdural haematomas, and widespread haemorrhagic retinopathy. Coexistent rib fractures, metaphyseal fractures, or other non-accidental injuries may be found. This is the commonest presentation seen by paediatricians and is referred to as the classic shaken baby syndrome (repetitive rotational injury). Depending on whether additional signs of impact are noted (focal subdural, extradural, or subgaleal haemorrhage; scalp injury; or skull fracture), the syndrome has been referred to as the shaken impact syndrome.

The brain injury is well documented from studies of magnetic resonance imaging,<sup>2</sup> which show widespread vascular shearing with convexity subdural haemorrhages enlarging over the first week (as well as interhemispheric, subtemporal, suboccipital, and posterior fossa subdural haemorrhages), torn bridging veins, cerebral oedema, haemorrhagic contusions and lacerations, and white matter shearing, with tears and petechial haemorrhages at the junction between grey and white matter and in the corpus callosum. Up to 60% of cases have serious long term morbidity.

#### *Subacute non-encephalopathic presentation*

In infants with a non-encephalopathic subacute presentation (19% of cases) the brain injury is less intense, without swelling, diffuse cerebral hypodensities, or clinical encephalopathic features. These children have various combinations of subdural and retinal haemorrhages, rib fractures and other skeletal fractures, bruising, etc. The outcome in this group is better.

#### *Chronic extracerebral presentation*

A chronic extracerebral presentation (22% of cases) is seen in children of a few months of age who present with an isolated subdural haemorrhage, which is often chronic (>3 weeks) and late in presenting. A rapidly expanding head circumference and signs of raised intracranial tension are common: the child may be irritable, vomiting, failing to thrive, hypotonic, fitting but with little encephalopathy.

The primary injury is extracerebral but with potential secondary injury from raised intracranial pressure and reduced cerebral perfusion pressure and hypoperfusion, oedema, and metabolism to flow mismatch in the white matter.<sup>3</sup> Any retinal haemorrhages originally present have disappeared by presentation. The injury has occurred weeks earlier, and its force has been sufficient to rupture the weakest bridging vein(s) but insufficient to produce an acute encephalopathy. The prognosis is good with recognition and appropriate treatment.

Clinicians will have difficulty in attributing a causative mechanism and timing to such late presenting (idiopathic) subdural haemorrhages. Only in the presence of residual features of physical abuse (such as fractures), along with identifiable risk factors, would non-accidental injury be considered. Most cases remain aetiologically unexplained, although trauma remains the likely cause, but they are unlikely to be legally pursued beyond medical investigations and social work inquiry.

#### *Conclusions*

We postulate that a spectrum of clinical features is related to the intensity and type of injury in babies with inflicted brain injury, reconciling the clinical and neuropathological findings. Infants can be traumatically injured in many ways, and many instances are unwitnessed. Thus the generic term non-accidental head injury or inflicted traumatic brain injury should be used in preference to shaken baby syndrome, which implies a specific mechanism of injury.

After the history, examination, and investigations have been considered the following conclusions about the cause of brain injury can be reached: It is characteristic of, consistent with, possibly due to, or not the result of, non-accidental trauma.

**Robert A Minns** *consultant paediatric neurologist*  
Child Life and Health, University of Edinburgh and Royal Hospital for Sick Children, Edinburgh EH9 1LF  
Robert.Minns@ed.ac.uk

**Anthony Busuttil** *professor of forensic medicine*  
Forensic Medicine Unit, University of Edinburgh, Edinburgh EH8 9AG

Competing interests: None declared.

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1 Geddes JF, Hackshaw AK, Vowles GH, Nickols CD, Whitwell HL. Neuropathology of inflicted head injury in children. 1. Patterns of brain damage. *Brain* 2001;124:1290-8.

2 Barlow KM, Gibson RJ, McPhillips M, Minns RA. Magnetic resonance imaging in acute non-accidental head injury. *Acta Paediatr* 1999;88:734-40.

3 Shaver EG, Duhaime A-C, Curtis M, Gennarelli LM, Barrett R. Experimental acute subdural hematoma in infant piglets. *Pediatr Neurosurg* 1996;25:123-9.

### Subdural and retinal haemorrhages are not necessarily signs of abuse

EDITOR—The “serious data gaps, flaws of logic, and inconsistency of case definition” shown up by the evidence based case report of the shaken baby syndrome (p 754) and highlighted in the accompanying editorials (pp 719 and 720) will be of interest to the many parents who over the past 10 years have maintained that they have been wrongly accused and convicted of causing their children’s injuries.<sup>1-3</sup>

Furthermore, the recent evidence emphasised by Geddes and Plunkett that trivial falls and other minor injuries can give rise to the allegedly characteristic signs of subdural and retinal haemorrhages is consistent with a triad of possible alternative explanations for shaken baby syndrome. This triad has emerged from an analysis of 98 parental accounts reported to the support group the Five Percenters, each of the three being compatible with a distinct type of neuropathology.

The first is minor trauma (37% of cases). This group gives a history of minor trauma (such as a fall from a bed or sofa) with either immediate loss of consciousness or delayed presentation of an acute subdural bleed and retinal haemorrhages. This is in line with the recently reported series from the United States of independently witnessed minor falls resulting in an acute intracranial bleed, the retinal haemorrhages being caused by a sudden rise in retinal venous pressure as in Terson’s syndrome.<sup>4</sup>

The second is birth injury (29% of cases). The clinical presentation in the second group is quite different. There is a general period of variable length of non-specific symptoms such as vomiting and lethargy warranting repeated medical consultations until computed tomography shows the presence of a chronic subdural haemorrhage. The most likely aetiology is a subdural bleed at birth, which, though usually associated with prematurity or a difficult labour, can follow a normal delivery.<sup>5</sup>

The third is respiratory arrest (22% of cases). In this group the precipitating event is suggestive of respiratory arrest—often followed by attempts at resuscitation—that could result in the subdural and retinal haemorrhages characteristic of hypoxic encephalopathy. The findings that severe traumatic brain damage is not, as previously thought, present in these cases contradicts the assumption that such injuries could only have been induced by violent shaking.<sup>6</sup>

A fourth type of presentation, epileptiform seizures (12%) is presumably secondary to underlying intracranial disease—and is thus uninformative about possible aetiology.

These three patterns of clinical events—in the absence of other circumstantial evidence for non-accidental injury—offer a more credible explanation than shaken baby syndrome for the presence of subdural and retinal haemorrhages. It should be noted that shaking has never been directly observed or proved to cause such injuries but is rather an inference based on (contested) theories of

biomechanics.<sup>7</sup> By contrast, consistent parental testimony tallies with descriptions from independent witnesses. Furthermore, each pattern of clinical events is consistent with a distinctive type of neuropathology of acute subdural, chronic subdural, or the thin subdurals of hypoxic encephalopathy.

While we recognise the limitations of the volunteered parental testimony on which this analysis is based, the same triad of presentations—designated as acute encephalopathic, idiopathic subdural, and hyperacute presentation—has also been independently identified from an extended database of cases of suspected non-accidental injury (see previous letter).<sup>8</sup> These findings necessarily raise disturbing questions about the validity of the opinions expressed by medical experts in the courts. They warrant further, urgent, and appropriate scientific investigation.

**James LeFanu** *general practitioner*  
Mawbey Brough Health Centre, London SW8 2UD

**Rioch Edwards-Brown** *director*  
The Five Percenters, PO Box 23212, London SE14 5WB  
sbs5@dircon.co.uk

Competing interests: JLeF—none declared. RE-B is director of a voluntary organisation providing advice, information, and support to parents who state that they have been wrongly accused of shaken baby syndrome. Neither she nor any individual in the organisation has any financial competing interests.

- 1 Lantz PE, Sinal SH, Stanton CA, Weaver RG Jr. Perimacular retinal folds from childhood head trauma. *BMJ* 2004;328:754-6. (27 March.)
- 2 Geddes JF, Plunkett J. The evidence base for the shaken baby syndrome. *BMJ* 2004;328:719-20. (27 March.)
- 3 Harding B, Risdon RA, Krous HF. Shaken baby syndrome. *BMJ* 2004;328:720-1. (27 March.)
- 4 Plunkett J. Fatal pediatric head injuries caused by short-distance falls. *Am J Forensic Med Pathol* 2001;22:1-12.
- 5 Towner D, Castro M, Eby-Wilkins E, Gilbert W. Effect of mode of delivery in nulliparous women on neonatal intracranial injury. *N Engl J Med* 1999;341:1709-14.
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- 7 Ommaya AK, Goldsmith W, Thibault L. Biomechanics and neuropathology of adult and paediatric head injury. *Br J Neurosurg* 2002;16:220-42.
- 8 Minns RA, Busuttill A. Patterns of presentation of shaken baby syndrome. Electronic response to: Brain haemorrhage in babies may not indicate violent abuse. *bmj.com* 2003. [bmj.com/cgi/eletters/326/7390/616a](http://bmj.com/cgi/eletters/326/7390/616a) (accessed 17 July 2003).

### Reluctance in child protection must be for several reasons

EDITOR—In his news item Dyer reports that doctors are reluctant to work on child protection committees.<sup>1</sup> I have yet to meet a paediatrician who is genuinely keen to do child protection work. Not surprisingly, the Royal College of Paediatrics and Child Health is experiencing enormous difficulties filling the relevant posts.

Most paediatricians in training today do not wish to do community paediatrics in the future. It is certainly essential to have a named paediatrician for child protection in every hospital, but, ironically, in my experience, even the named paediatricians for child protection in some cases are reluctant to show passion in this field.

This general reluctance must be for several reasons, not least a lack of proper training. The royal college should look into this with an open mind. Also, why should only paediatricians have the responsibility for child protection work? There is no reason why other medical specialties such as general practice and orthopaedics should not take equal responsibility.

**Ashok Beckaya** *staff paediatrician*  
Epsom and St Helier University Hospitals Trust,  
Epsom KT18 7EG  
beckaya@aol.com

Competing interests: None declared.

- 1 Dyer O. Doctors reluctant to work on child protection committees, survey shows. *BMJ* 2004;328:307. (7 February.)

### Labouring in water

#### Method is unclear

EDITOR—The method of the study by Cluett et al comparing labouring in water with standard augmentation in managing dystocia requires clarification.<sup>1</sup> The authors have not defined the criteria by which the first stage of labour was diagnosed, thus putting into question the diagnosis of dystocia.

In current practice an expectant policy is advocated especially during the latent phase of labour, to avoid unnecessary intervention. It is unclear whether the authors have taken this into account and whether some women were inappropriately recruited.

We think that an alternative arm of the study should have included an expectant group without recourse to water immersion or augmentation and thus the true impact of water immersion would be defined. The inclusion of women with both intact and ruptured membranes in each study arm further adds to difficulty in evaluating the true effect of water immersion.

**Jamal Zaidi** *consultant obstetrician and gynaecologist*  
Conquest Hospital, St Leonards on Sea,  
East Sussex TN37 7RD  
jamal.zaidi@esht.nhs.uk

**Fawzia Zaidi** *senior lecturer, midwifery*  
University of Brighton, East Sussex

Competing interests: None declared.

- 1 Cluett ER, Pickering RM, Getliffe K, Saunders NJ. Randomised controlled trial of labouring in water compared with standard of augmentation for management of dystocia in first stage of labour. *BMJ* 2004;328:314. (7 February.)

#### Findings do not fully support conclusions

EDITOR—The study by Cluett et al, comparing labour in water with standard augmentation for dystocia, tackles an important area.<sup>1</sup> Too often modern obstetrics concentrates on major medical interventions and neglects the low tech solutions that many women would prefer.<sup>2</sup>

Despite the study’s robust design the findings do not fully support the conclusions. Neither of the primary outcomes (epidural rates and assisted delivery rates) differed significantly between the two groups: only by combining all outcome

- 1 Rawlins MD, Culyer AJ. National Institute for Clinical Excellence and its value judgments. *BMJ* 2004;329:224-7. (24 July.)
- 2 Maynard A, Bloor K, Freemantle NK. Challenges for the National Institute for Clinical Excellence. *BMJ* 2004;329:227-9. (24 July.)

### Authors' reply

EDITOR—Caan may be right about second line treatments, but the point applies to more than just paediatric prescribing. Fortunately, there is nothing in NICE's current appraisal methods to exclude these considerations,<sup>1</sup> and we have already done so on several occasions.

House and Peters are wrong to call NICE's values utilitarian, but they are certainly consequentialist. By this we mean that NICE evaluates the likely consequences of using the technologies; this is certainly economic in trying to quantify consequences, being explicit about the value judgments involved, and taking account of the NHS resources that will be used. Whether health is better promoted by means beyond the NHS is pertinent, although it not a question NICE has been charged with answering.

We have much sympathy with what elsewhere is called the population health approach. From next April, guidance on public health will form part of NICE's portfolio. Rao also supports this approach but does not approve of the selection of technologies we review. Topics are selected by ministers after widespread consultation, and they are certainly not set by manufacturers.

We think it inevitable that any attempt to create fairness in access to medicines in England and Wales is bound to compromise some "local priorities." But it was, of course, differing "local priorities" that created the postcode prescribing in the first place, and the public will not tolerate its re-emergence. We readily concede that NICE's recommendations entail difficult choices about resource allocation, but we emphasise that no local decisions about allocation of resources are subjected to anything approaching the rigour of NICE's approach to cost effectiveness. Neither is there any distant analogy between our procedures and wartime "rationing," which both of us vividly remember.

**Michael Rawlins** *chairman*  
National Institute for Clinical Excellence, London  
WC1V 6NA  
[m.drawlins@ncl.ac.uk](mailto:m.drawlins@ncl.ac.uk)

**Tony Culyer** *chief scientist*  
Institute for Work and Health, Toronto, Canada

Competing interests: None declared.

1 National Institute for Clinical Excellence. *Guide to the methods of technology appraisal*. London: NICE, 2004.

## The evidence base for shaken baby syndrome

### Meaning of signature must be made explicit

EDITOR—Reece et al's response to the editorial of Geddes and Plunkett claims to be a response of "106 doctors."<sup>2</sup> What, precisely,

do the 106 signatures attached to this letter signify? That all had reviewed the letter and were in full agreement with the entire content? That they agreed in general with the thrust of the letter? Or was this more a show of solidarity on the part of doctors who care deeply about the risks of shaking on children?

This needs clarification if the signatures are to carry any weight whatsoever. Science—even medical science—is not a popularity contest. The meaning of a signature must be made explicit for it to add weight to a document.

Each signature carries with it responsibilities of authorship. Reece's letter declared no competing interests, but all signatories would need to comply for this to be true.

Six of the signatories (Levin, Chadwick, Alexander, Barr, Jenny, and Reece) are medical practitioners on the International Advisory Board of the National Center on Shaken Baby Syndrome ([www.dontshake.com](http://www.dontshake.com)). They participate in this group's conferences and are presumably compensated or reimbursed for this work—information requiring disclosure under *BMJ* guidelines.

The letter of Reece exemplifies a problem identified in my own paper<sup>3</sup>—that the literature on shaken baby syndrome is polarised and based more on strong beliefs and opinions than strong data. Ten thousand signatures cannot change this.<sup>4</sup>

**Mark Donohoe** *general practitioner*  
Mosman, NSW 2088, Australia  
[drmark@bigpond.net.au](mailto:drmark@bigpond.net.au)

Competing interests: None declared.

- 1 Reece RM. The evidence base for shaken baby syndrome. *BMJ* 2004;328:1316-7. (29 May.)
- 2 Geddes JF, Plunkett J. The evidence base for shaken baby syndrome. *BMJ* 2004;328:719-20. (27 March.)
- 3 Donohoe M. Evidence-based medicine and shaken baby syndrome. Part I: literature review, 1966-1998. *Am J Forensic Med Pathol* 2003;24:239-42.
- 4 Davies S, Downing D. Truth, ethics and consensus—their relation to medical progress and the quality of patient care. *J Nutr Med* 1992;3:91-8.

### Competing interest declaration of the 106 authors and an editorial explanation

EDITOR—The *BMJ* asked my co-authors and me to complete a competing interests form only after our letter was published.<sup>1 2</sup>

Competing interest declaration: Many of the letter's authors practise, teach, lecture, consult, and do research on matters involving child abuse, including shaken baby syndrome. Some lecturers receive honorariums for their lectures, many of which are given to the lecturer's institution.

Some receive research funding for a variety of projects. Many have testified in civil and criminal courts, having been called in the main, though not exclusively, by departments of social services, families, prosecution, and defence. They are generally paid for their time.

Some serve on non-profit boards of organisations with concerns about child maltreatment, including shaken baby syndrome, and are not compensated for this service.

**Robert M Reece** *clinical professor of paediatrics*  
PO Box 523, 122 Hawk Pine Road, Norwich, VT  
05055, USA  
[rmreece1aol.com](mailto:rmreece1aol.com)



\*\*It is our policy to obtain a competing interest declaration before publication. In this case our oversight occurred because Professor Reece's letter did not come in the usual way via [bmj.com](http://bmj.com) and our checking mechanisms failed—EDITOR

- 1 Reece RM. The evidence base for shaken baby syndrome. *BMJ* 2004;328:1316-7. (29 May.)
- 2 *BMJ* declaration of competing interests. Available at: <http://bmj.bmjournals.com/cgi/content/full/317/7154/291/DC1> (accessed 17 Sep 2004).

### Response to Reece et al from 41 physicians and scientists

EDITOR—Reece et al have implied that child abuse is a particularly difficult area in which to conduct research.<sup>1</sup> This difficulty does not justify circular reasoning, selection bias, imprecise case definition, unsystematic review publications, or conclusions that overstep the data.<sup>2-5 w1-w5</sup>

Geddes and Plunkett described the use of evidence based medicine in evaluating the causes of head injury in infants and children.<sup>w4-w5</sup> Evidence based medicine is the conscientious, explicit, and judicious use of scientific evidence in making medical decisions and cautions against unsystematic, untested reasoning and intuition based clinical applications. It integrates scientific principles and clinical experience with valid, current research.<sup>w6</sup>

While much of clinical medicine still relies on observation, it is critical that these observations are verified and validated. Often, the clinician must be more deliberate than the experimentalist who uses a planned systematic approach. The clinical researcher may have to await the natural sequence of events—deducing relationships that lie below observed phenomenon, being more logical and less dogmatic, and avoiding the fallacy of mistaking correlation with causation.<sup>w7</sup> If the principles of science and evidence based medicine are not critically applied to observational studies, a set of formulated beliefs among like-minded people may be reinforced, leading to misconceptions and misinterpretations. When this occurs, the primary principle of medicine—first, do no harm—may be violated.

Child abuse in any form is always unacceptable. However, if errors in diagnosis, false accusations, and wrongful convictions result from untested and unverified beliefs, then we have done harm.

Critically evaluating one's own understanding is far more constructive than

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criticism of those who differ. If we can approach differences objectively and resolve them with rational analysis, then we have moved decisively towards answering difficult questions.

**Patrick E Lantz** *forensic pathologist*  
Wake Forest University Health Sciences,  
Winston-Salem, NC 27157, USA  
[plantz@wfubmc.edu](mailto:plantz@wfubmc.edu)

This letter is signed by another 40 physicians and scientists (see [bmj.com](http://bmj.com) for details).

Competing interests: See [bmj.com](http://bmj.com)

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**P+** Details of the other 40 signatories and all competing interests are available on [bmj.com](http://bmj.com), as are references w1-7.

## Post-immigrant refugee medicine

### Population mobility must be considered

EDITOR—Adams et al highlight the importance of pre-departure and migration history in post-immigration refugee medicine,<sup>1</sup> but health professionals must also consider the ongoing reality of mobility in this population.<sup>2</sup>

For example, a newcomer, in whom diabetes has been diagnosed during screening, happens to mention the recent death of her mother. This leads to the discovery of plans to travel back home to the Sudan and a timely provision of health advice, malaria prophylaxis, and a summary of drug treatment.

Population mobility in the context of refugees refers to the forced movement of people beginning before departure and continuing for years, sometimes a lifetime, as people search for a place to call home. Historically, refugee programmes have focused only on early integration: screening and disease treatment. Refugees will often continue to move as they seek community support and employment, and they will often return to home (or near to home) countries to visit friends and relatives.

These movements unveil global health disparities related to diseases and access to health care—for example, immigrants are at increased risk of travel related illness.<sup>3</sup> Immigrants are often unaware of the importance of travel advice and disease prevention strategies. Acknowledging the reality of this mobility can allow for a systematic delivery of advice on travelling home, health promotion for cancers and cardiovascular diseases,<sup>4</sup>

and low cost mechanisms to communicate and transfer medical histories.

**Kevin Pottie** *assistant professor*  
[kpottie@uottawa.ca](mailto:kpottie@uottawa.ca)

**Patricia Topp** *program coordinator*  
**Frances Kilbertus** *assistant professor*  
Immigrant Health and Visiting Friends and Relatives Program, University of Ottawa, 75 Bruyere Street, Ottawa, ON, Canada K1N 5C8

Competing interests: None declared.

- 1 Adams KS, Gardiner DL, Assefi N. Healthcare challenges from the developing world: post-immigration refugee medicine. *BMJ* 2004;328:1548-52. (26 June).
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- 4 Gavagan T, Brodyaga L. Medical care for immigrants and refugees. *Am Fam Physician* 1998;57:1061-8.

### Children's needs should not be seen in isolation

EDITOR—Adams et al discussed the challenges of post-immigrant refugee medicine.<sup>1</sup> The physical and mental health needs of refugee children are unique. Children comprise nearly half of the refugee population in many countries and may arrive malnourished without any screening or immunisation. They need culturally sensitive dietary advice and information about sexual habits and avoiding drugs.

Despite increasing focus on the mental health of refugee children, research data are lacking.<sup>2</sup> Some researchers have found an increased risk of post-traumatic stress disorder, depression, and anxiety.<sup>3</sup> Others found no differences between the incidence of psychiatric disorders in refugee children and the local population.<sup>4</sup> Whether this reflects better assimilation of these children into the society or unknown variables remains to be explored.

Children are worried not just about health but about loss of family members, loneliness, feeling cold, being depressed, lack of money, being bullied, language barriers, and being used as interpreters for their parents.<sup>5</sup> They may not seek care for legal reasons or fear of persecution.

Doctors need training in interviewing skills that explore these unique issues and awareness of locally available resources to act as advocates on their behalf. Collaboration between doctors and mental health, social, and education services is required. Children's needs should not be seen in isolation but in the context of their families. The best way to help them is to help their families. A timely understanding of these needs will be critical in safeguarding our future.

**Sonal Singh** *resident physician*  
1555 Long Pond Road, Department of Medicine,  
Unity Health System, Rochester, NY 14626, USA  
[ssingh@unityhealth.org](mailto:ssingh@unityhealth.org)

Competing interests: None declared.

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## Millennium development goals: whose goals and for whom?

EDITOR—Millennium development goals are the most recent statement of commitment towards narrowing gaps between the developed and developing regions of the world.<sup>1</sup> But how realistic are these goals?

Although goals help in making assessments of progress, they should not be blind to existing potentials for progress, which is conditioned by the existing status as well as the motivation of nations and states towards realising them. Unfortunately, millennium development goals are considered to be a tool for assessing accountability and highlight a need for urgency that could violate the autonomy of nations and states. This raises the question of whose goals they are.

Often such initiatives are seen as global priorities, overriding local concerns. The best example is the vaccination initiative, which has consistently reflected failures by countries without the required infrastructure. In other circumstances, such externally aided initiatives are never integrated into the local health system to make the most of such intervention. In terms of measuring the extent of achievement of such goals, caution is advised in assessing progress conditioned by local realities that may not always be conducive to making the expected progress.

Finally, who benefits from the achievement of such goals needs to be made clear. Would there be any space to account for inequities resulting in achievement of such goals? If yes, the assessment of progress in achieving these goals needs to make adjustments for this to have a realistic evaluation of progress.

**Udaya S Mishra** *Takemi fellow*  
Department of Population and International Health, Harvard School of Public Health, 665, Huntington Avenue, Boston MA 02115, USA  
[umishra@hsph.harvard.edu](mailto:umishra@hsph.harvard.edu)

Competing interests: None declared.

- 1 Haines A, Cassels A. Can the millennium development goals be attained? *BMJ* 2004;329:394-7. (14 August).

## Women in medicine

### Doctors of both sexes are seeking balance between life and work

EDITOR—The Medical Women's Federation supports Heath's statement in her editorial that all occupations should seek to mirror the demography of society.<sup>1</sup> Child care support at levels found in Scandinavian countries would greatly support women in medicine to achieve their potential. How-

## [The 41 signatories to the letter and competing interest statements](#)

### [References](#)

#### **The 41 signatories to the letter and competing interest statements**

Competing interests: We are physicians and scientists who have a common interest in applying the principles of science and medicine to infant injury evaluation. Each of us either participated in writing this letter or reviewed it prior to submission. Each of us agrees with its content.

FAB, PDB, TC, BJC, DLC, VJMD, LJD, JEL, PEL, DM-P, MDN, AKO, JO, GR, SJR, MJS, PS, WS, JBS, ST, HW, and PW have consulted or testified for the prosecution and the defence as part of their official salaried responsibilities , as paid consultants or pro bono in fatal and non-fatal alleged child abuse cases.

RS has given evidence to the Courts (not for either prosecution or defence) and has been reimbursed by the public Legal Aid system.

JHD, GS, and LCT have testified for the prosecution in fatal alleged child abuse cases as part of their official salaried responsibilities.

JG, HG, RJ, REM, MM, KT, JBL, RR, JS, RU, CVE, and EW have consulted and testified for the defence pro bono and as paid consultants in fatal and nonfatal alleged child abuse cases.

TLB, KM and JN have no competing interests other than as stated in the first sentence above.

None of us answers, "Yes" to Questions 1, 2, 3 or 5 in the BMJ "Declaration of competing interest".

Patrick E. Lantz  
Forensic Pathologist  
Associate Professor of Pathology  
Wake Forest University Health Sciences  
Winston-Salem, NC 27157

Marvin Miller  
Paediatric Geneticist  
Professor of Paediatrics and  
Obstetrics/Gynaecology  
Affiliated Professor of Biomedical Engineering  
Wright State University School of Medicine  
Dayton, OH 45404

Kirk L. Thibault  
Biomechanical Engineer  
Philadelphia, PA 19112

Mark J. Shuman  
Forensic Pathologist  
Associate Medical Examiner  
Miami-Dade County Medical Examiner  
Department  
Miami, FL 33179

Gregory D. Reiber  
Forensic Pathologist  
Associate Clinical Professor of Pathology  
University of California Davis School of  
Medicine  
Sacramento, CA 95817

Patrick D. Barnes  
Paediatric Neuroradiologist  
Associate Professor of Radiology  
Stanford University Medical Centre  
Palo Alto, CA 94305

Faris A. Bandak  
Injury Biomechanician  
Professor, Dept of Neurology  
F. Edward Hébert School of Medicine  
Uniform Services University of the Health  
Sciences  
Bethesda, MD 20814

Thomas L. Bohan  
Physicist and Attorney  
Portland, ME 04101

Thomas Carlstrom  
Neurosurgeon  
Iowa Methodist Medical Centre  
Des Moines, IA 50309

Brian J. Clark  
Consultant Ophthalmic Pathologist  
Moorfield Eye Hospital & Institute of  
Ophthalmology  
University College  
London, England

Dimitri L. Contostavlos  
Forensic Pathologist  
West Chester, PA 19382

Joseph H. Davis  
Forensic Pathologist  
Professor of Pathology Emeritus  
University of Miami  
Miami, FL 33176

Vincent J. M. DiMaio  
Forensic Pathologist  
Chief Medical Examiner, Bexar County  
San Antonio, TX 78229-4565

Ljubisa J. Dragovic  
Forensic and Neuropathologist  
Chief Medical Examiner, Oakland County  
Pontiac, MI 48341

John Galaznik  
Paediatrician  
Northport, AL 35476

Horace Gardner  
Ophthalmologist  
Manitou Springs, CO 80829

Ron Jollo  
Family Practitioner  
Bend, OR 97709

Jan E. Leestma  
Consultant Neuropathologist  
The Children's Memorial Hospital  
Chicago, IL 60614

John B. Lenox  
Trauma Medical Research Physician and  
Biomechanical Engineer  
San Antonio, TX 78216-5144

Roger E. McLendon  
Professor of Pathology (Neuropathology)  
Duke University Medical Centre  
Durham, NC 27710

Darinka Mileusnic-Polchan  
Forensic Pathologist  
Assistant Chief Medical Examiner for Knox  
County  
Assistant Professor of Pathology  
University of Tennessee Medical Centre  
Knoxville, TN 37922

Kenneth Monson  
Biomechanical Engineer  
Department of Neurological Surgery  
University of California San Francisco Medical  
Centre  
San Francisco, CA 94143

Marvin D. Nelson, Jr.  
Paediatric Neuroradiologist  
John L. Gwinn Professor of Pediatric Radiology  
Childrens Hospital Los Angeles  
Professor of Radiology  
USC Keck School of Medicine  
Los Angeles, CA 90027

Julie Niedermier  
Psychiatrist  
Columbus, OH 43214

Ayub K. Ommaya  
Clinical Professor of Neurosurgery  
Georgetown University  
Washington, DC 20057

Janice Ophoven  
Paediatric Forensic Pathologist  
Woodbury, MN 55129

Richard Reimann  
Physicist  
Department of Physics  
Physics Department  
Boise State University  
Boise, ID 83725-1570

Susan J. Roe  
Forensic Pathologist  
Minneapolis, MN 55414

Gert Saayman  
Forensic Pathologist  
University of Pretoria  
Pretoria, SA 0001

Joseph Scheller  
Assistant Professor of Paediatrics and  
Neurology  
George Washington University School of  
Medicine  
Washington, DC 20037

Waney Squier  
Consultant Neuropathologist and Honorary  
Clinical Lecturer  
Radcliffe Infirmary  
Oxford, England OX2 6HE

Peter Stephens  
Forensic Pathologist  
Burnsville, NC 28714

John Stephenson  
Paediatric Neurologist  
Glasgow, Scotland G3 8SJ

Robert Sunderland  
Senior Clinical Lecturer in Paediatrics  
University of Birmingham  
Consultant Paediatrician  
Birmingham Childrens' Hospital  
Birmingham, England B4 6NH

Shaku Teas

Forensic Pathologist  
River Forest, IL 60305  
Linsey C. Thomas  
Forensic Pathologist  
Minneapolis, MN 55419

Helen Whitwell  
Professor of Forensic Pathology and  
Neuropathology  
Medico-Legal Centre, University of Sheffield  
Sheffield, England S3 7ES

Ronald Uscinski  
Neurosurgeon  
Clinical Professor of Neurosurgery and  
Paediatrics  
Georgetown University  
Washington, DC 20007

Ed Willey  
General and Forensic Pathologist  
St. Petersburg, FL 33707

Philip Wrightson  
Neurosurgeon (retired)  
Auckland 1005, NZ

Chris Van Ee  
Biomechanical Engineer  
Design Research Engineering  
Novi, MI 48377

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