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Minimising Bias in the Forensic Evaluation of Suspicious Paediatric Injury.

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ABSTRACT

In the rules of evidence in all legal jurisdictions, medical experts are required to maintain objectivity when providing opinions. When interpreting medical evidence, doctors must recognise, acknowledge and manage uncertainties to ensure their evidence is reliable to legal decision-makers. Even in the forensic sciences such as DNA analysis, implicit bias has been shown to influence how results are interpreted from cognitive and contextual biases unconsciously operating. In cases involving allegations of child abuse there has been significant exposure in the media, popular magazines, legal journals and in the published medical literature debating the reliability of medical evidence given in these proceedings. In these cases judges have historically been critical of experts they perceived had sacrificed objectivity for advocacy by having an investment in a 'side'. This paper firstly discusses the issue of bias then describes types of cognitive biases identified from psychological research applied to forensic evidence including adversarial bias, context bias, confirmation bias and explains how terminology can influence the communication of opinion. It follows with previously published guidelines of how to reduce the risk of bias compromising objectivity in forensic practices then concludes with my own recommendations of practices that can be used by child protection paediatricians and within an organisation when conducting forensic evaluations of suspicious childhood injury to improve objectivity in formulation of opinion evidence.

Key words

Paediatric, forensic medicine, suspicious, injury, bias, medical uncertainty

INTRODUCTION: THE ISSUE OF BIAS

Within the rules of evidence in all legal jurisdictions, medical experts are required to maintain objectivity when formulating opinion¹. In the courtroom legal advocates use cross-examination to expose bias if it is present. In contrast to **explicit bias** which is part of a person's conscious awareness such as generalised assumptions based on age, gender or race, **implicit bias** is one that an individual holds without being aware, and is therefore more difficult to acknowledge or control.

Making decisions under conditions of ambiguity and uncertainty is fundamental to being a professional. Every evidence-based decision is fundamentally a risk decision². How doctors respond to uncertainty in medical evidence will influence reliability of opinions given in legal settings. The lay person may erroneously assume that science always holds definitive and reliable answers. It can be argued that science is a fluid concept, with new techniques and approaches evolving over time. Evaluating science is complex, challenging to test and at times difficult to convey to a lay audience. There is an inherent risk that opinions given in evidence may sound more definitive than they actually are and hence be less reliable to the tribunal of fact.

Failure to acknowledge uncertainties are a common failing of forensic disciplines. The report "Strengthening Forensic Science in the United States" published in 2009 recognised the problems of error in forensic evidence involving the forensic sciences³. For forensic evidence to be admissible in criminal trials and be considered as reliable, depends on the extent to which the forensic discipline is founded on a reliable scientific method giving it the capacity to accurately analyse evidence and report findings³. This report highlighted the issue that in particular, forensic disciplines relying on human interpretation could be tainted by error and introduce bias through the absence of sound operational procedures or robust performance standards³. Bias and other cognitive influences unconsciously affect hard-working, honest and dedicated forensic experts, creeping in without the expert's awareness. This is a difficult and interesting problem and applicable across all forensic domains of medico-legal practice.

Forensic medicine is an interpretative science, which is less objective than analytical sciences such as DNA analysis. It requires the forensic expert to synthesise elements of experience, descriptive studies, clinical trials, meta-analyses and apply this knowledge to one patient to determine injury plausibility. In addition to scientific knowledge, clinical experience is also valued. Experts must recognise and manage uncertainty including conceptual uncertainty of central issues of injury causation then apply what is known to a concrete scenario. The scientific knowledge basis relevant to evaluating suspicious childhood injury is broad, spanning many disciplines including pathology, biomechanics, paediatric medicine, orthopaedics and radiology. Paediatricians have expertise in understanding disease in children, normal health and development and in the diagnosis of injuries in childhood.

In cases involving allegations of child abuse, judges have historically been critical of experts they perceived had sacrificed objectivity for advocacy by having an investment in a 'side'^{4,5}. Police have sometimes questioned the ability of a forensic physician assessing sexual assault victims to remain objective and not to overly identify with the victim⁶.

In high profile cases involving allegations of child abuse there has been intense media exposure debating the reliability of medical evidence given in these proceedings, and in particular the

diagnosis of “shaken baby syndrome”. Law review journals, popular magazines and online scientific forums have been devoted to publishing papers, articles and debates on this topic and in particular focused the spotlight on the possibility that the medical evidence relied on by the courts in successful convictions may be fundamentally flawed⁷⁻¹⁰. Within published peer-reviewed medical literature there has significant attention and debate about biases presented by defense experts relating to what have been referred to as ‘unique theories of causation’ such as the Unified Hypothesis¹¹ and Temporary Brittle Bone Disease¹² which have lacked scientific support yet been offered as explanations for findings that are generally accepted as derived from inflicted trauma mechanisms¹³⁻¹⁵. The biases of these experts are thought to be in the direction of concluding a natural explanation rather than objectively considering harm and have been subject to judicial rebuke¹⁶.

Media scrutiny involving allegations of child abuse have extended to Government Inquiries and professional regulatory bodies examining perceived biases in experts involved in these legal proceedings^{2, 17, 18}. In Ontario, Canada during the Goudge Inquiry, the Commissioner discussed what was referred to as a “think dirty” cultural practice amongst forensic pathologists, derived from having an excessive index of suspicion of child abuse during the investigation of unexplained infant deaths¹⁹. Goudge considered this perspective biased the pathology opinions given in court proceedings. During the Inquiry the Commissioner heard from various experts of the unstable or uncertain knowledge in many of the key forensic issues relating to infant death. In contrast to the many Inquiries that had preceded it which had demanded professionals err on the side of safety, Goudge observed that such an approach may potentially generate unacceptable risks elsewhere in the legal process, and in particular risked miscarriages of justice²⁰.

CAUSES OF BIAS: PUBLISHED RESEARCH

Cognitive biases

In medical diagnosis, clinicians experience a cyclical interplay between pre-existing schema, which are the mental categories constructed from experience and belief that provide the framework for perception, reasoning and uptake of new information²¹. Medical curricula that is schema-structured, that is, grouped by relevant clinical and patho-physiologic variables, enables knowledge to be stored in a clinically relevant way²². This encourages ‘forward reasoning’ based on clinical data rather than the less efficient and more unreliable ‘backward reasoning’ which starts with a hypothetical diagnosis then seeks clues in the history/examination to support it²².

Generally speaking in medicine, cognitive errors that can lead to misdiagnosis include the following types:

Premature closure /anchoring: This involves failing to appreciate there is more to know before forming a view, possibly from faulty data gathering or failing to revise diagnosis in light of new information.

‘Tunnel vision’: This involves seeing an incident from a personal perspective or through a narrow lens.

Faulty context generation: Referred to as context bias, this refers to the significance of findings as dependent on the context it is thought to exist in. In Carol Jenny’s landmark study of missed abusive

head trauma (AHT) cases, Jenny found missed abusive head trauma was more frequent in children who were white or were insured, highlighting biases related to psycho-social contextual factors²³. Other researchers have shown socio-economic status (SES) had more effect on paediatricians conclusion of abuse than race despite identical histories^{24, 25}. Radiology is a good example of how context can alter findings. A forensic approach to reporting imaging should not take the alleged history into account but instead be restricted to identifying then interpreting radiological findings to construct a differential diagnosis of cause.

Flawed heuristics. This involves the “pattern recognition” approach to diagnosis which may be erroneous, over-inclusive and have inherent “blindspots” which may lead to diagnostic error (see Box 1- The Cognitive Continuum).

Social drivers. The term “**Groupthink**” has been coined to represent a strong compulsion within certain groups to reach unanimous decisions. Although reaching a unanimous decision may be seen as useful, it is problematic when the goal to reach consensus compromises objectivity. This process clearly operates in jury decisions and has been identified as the cause of erroneous convictions²⁶. Social drivers underpin the mechanism, such as feeling intimidated or wanting to conform or giving deference to those with perceived seniority/greater expertise.

Hindsight bias involves retrospective suspicion that was not present initially in light of new findings. This exists in radiology reporting, overlapping with **outcome bias** which arises when, following awareness of new findings, greater significance is assigned to findings that in isolation were not at the time considered to be of significance²⁷.

Terminological issues

The language used in documentation and in medico-legal reports is critical in communicating medico-legal opinion which must be understood in the way intended by the expert²⁸. To explore this issue in the context of suspicious childhood injury, research has been undertaken using scripted cases which required appointed experts to define the ‘child physical abuse likelihood’. Results from these studies identified broad variation in the assigned conclusions between experts assessing the same cases²⁹⁻³². One study observed clustering of responses at the ends of the decision spectrum (‘definite inflicted’, ‘definite unintentional’) in expert responses, with much fewer participants classifying the cases as ‘uncertain’ from the data supplied²⁹. Research of this type has exposed some of the practical difficulties experienced by forensic specialists in communicating opinion. Some participants noted the requirement in the study to classify cases using the terms ‘unintentional’, ‘accidental’, ‘abusive’, which required consideration of intent to be problematic due to inherent subjectivity and potentially trespassed into judicial decision-making. These participants were aware the term chosen may significantly influence legal decision-making³⁰.

Adversarial bias/allegiance

In colloquial terms this type of bias has been referred to as the issue of the “hired gun”. It is possible that lawyers retained to represent a client may choose experts that have pre-existing attitudes that favour their client. It is also possible that lawyers may choose only to call experts with the most favourable findings to testify in court, which are both **selection effects**. These factors are outside the control of the medical expert. Experts may, once retained and promised payment form opinions

that favour one side which is referred to as *allegiance effects*. This bias is within the control of the forensic expert.

To test whether such biases exist using an experimental study design controlling for chance, random measurement error or pre-existing differences between groups forensic psychologists were recruited to determine risk of future offending for scripted cases³³. Even without selection effects, the “pull” of adversarial allegiance was clearly shown to influence the experts’ opinions. The researchers opined that in real cases such “pull” may be greater than the experimental conditions which was restricted to provision of only a written opinion and limited contact with the lawyer, suggesting the amount of contact the expert has with the solicitor as a key factor operating in allegiance effects. In this study, the exact source of bias could not be actually defined but may have been derived from a sense of team loyalty, monetary payment or promise of future work. Such biases may be more pronounced in disciplines that involve greater subjective clinical judgement.

Confirmation bias

Julius Caesar famously once said: “Men generally believe quite freely what they want to be true”. Modern cognitive scientists refer to this as confirmation bias, the tendency to test a hypothesis by looking for instances that confirm it rather than by searching for potentially falsifying instances. Psychological research has identified a number of factors relevant to reliability which influence how people tend to seek, perceive, interpret and create new evidence in ways that verify their pre-existing beliefs³⁴. An observers expectations can impact on visual and auditory perception. Globally these factors are referred to as “observer effects” in social psychology and research methodology, involving “expectation” and “suggestion” which are susceptible to extraneous influences such as emotional context, expectation and motivation³⁵. Within the forensic sciences these factors are considered highly relevant, in particular in forensic science practices utilising subjective human judgment as their primary instrument rather than those based on techniques derived from empirical scientific methods²¹.

Confirmation biases are a natural and automatic feature of human cognition that can occur in the absence of self-interest and operate without conscious awareness. Forensic examiners are aware of, and trained to avoid physical contamination to protect the integrity of evidence, yet “psychological contamination” has not received similar attention and is considered by some to be widespread in the forensic sciences³. Applying this concept to child protection assessments, this involves the influence of what is already considered by other professionals as suspicious to anchor the forensic/child protection paediatrician’s own conclusion. This may inadvertently lead to selective filtering of other information that becomes available at a later time which may have relevance to alternative causes of the findings.

Contextual bias

Having excess knowledge beyond what is required to carry out a scientific analytical task can inadvertently influence how objective data may be interpreted. Classic psychological research on primacy, expectancy effect and observer effects have all shown that context can taint peoples perceptions, judgments and behaviours³⁴. Despite DNA being once regarded as objective and immune to subjectivity and bias, it has been clearly shown that context can influence interpretation of DNA evidence using a variety of experimental methodologies including identification of

contradicting decisions by the same expert with experimental manipulation of context³⁶⁻³⁸. In particular, interpreting complex situations such as DNA mixtures relies on human examiners making a variety of subjective judgements that are susceptible to bias³⁷. Contextual biases which can taint the experts conclusions can all potentially be introduced through receiving direct communication from police, or from cross-communication amongst examiners involved in a case³⁷. In suspicious childhood injury, it has been shown that the approach to investigation of a presenting symptom such as bruising may vary depending on the specialty domain of the medical expert³⁹. A subspecialist is more likely to consider a rare condition as a possibility than a generalist⁴⁰. Pathologists generate different opinions from the same findings as paediatricians regarding the likelihood of abuse³⁰.

In the US following the development of the new child protection board specialty, there was debate as to whether it should be called 'forensic pediatrics' or 'child abuse pediatrics'. This represented differing views as to whether role of the child protection paediatrician should include their own evaluation of the family as a basis for forensic medical opinion. The philosophy of the paediatrician can influence how consultation notes are documented in the medical record⁴¹. Classifying child protection paediatrician models of assessment from reviewing medical documentation using the terms 'Base model', 'Investigative model', and 'Family-dynamic model,' Keenan and Campbell queried whether using an investigative model may blur boundaries between diagnosis and investigation or legal decision-making involving other professionals. These authors opined that the family dynamic model contains data that may be relevant to risk which inform the needs of the family but should not be considered as diagnostic of causation of injury. As a limitation of this study, it could not determine if the approach adopted by the paediatrician impacted on medical diagnosis, investigative responses or legal outcomes.

Professor David in the UK had previously published a caution for child protection paediatricians that by including risk factors for abuse as a basis for medical forensic opinions, this may potentially bias the reader of the report of apparently maladaptive parental responses as suggestive of guilt.⁴²

MANAGEMENT OF BIAS: PUBLISHED GUIDELINES FOR PRACTICE

Managing patient advocacy bias: Other forensic specialities have recognised that experts with treatment responsibilities should be separate from the experts who have a forensic responsibility to the courts. In mental health proceedings, forensic psychiatrists are considered more objective than the treating doctor who may be inadvertently biased towards their patient^{41, 43}. This draws attention to the importance within institutions of creating a clear separation between specialists with forensic functions from those with treating responsibilities.

Managing terminological biases: In the report "Strengthening Forensic Science in the United States" the authors recommended that forensic experts adopt standardised terminology in reporting on, and testifying about, the results of forensic science investigations including scales to communicate their strength of opinion³. This was also echoed by Goudge during the Goudge Inquiry which also recognised that language introduced bias in communicating evidence to the tribunal of fact and recommended it as a priority area for scientific development to be adopted across all forensic disciplines^{19, 20}.

Managing cognitive biases: The Goudge Report also noted that many forensic disciplines lack best practices or any coherent structure for the enforcement of operating standards, certification and

accreditation¹⁹. It signalled the need as a priority for oversight and enforcement of operating standards, certification, accreditation and ethical standards to be developed in the forensic sciences. The report also recommended that research should be undertaken to determine the effects of contextual bias in forensic practices and research on sources of human error should be closely linked with research conducted to quantify and characterise the amount of error. In addition it recommended professional organisations should develop standard operating procedures to minimise to the greatest extent possible, potential bias and sources of human error within forensic practice.

PRACTICE RECOMMENDATIONS FOR EVALUATION OF SUSPICIOUS CHILDHOOD INJURY

This section summarises individual and systemic practices that I consider useful in the forensic assessment of suspicious childhood injury to mitigate bias compromising objectivity of forensic opinions:

1. ***Separate forensic assessments from advocacy in child protection:*** There are inherent risks that employment in a child protection service may inadvertently cultivate a proscetorial bias in childhood injury assessment. This could relate to perceptions of membership as part of the investigative team. An implicit bias in assessment may be towards concluding abuse at the expense of objective consideration of an alternative plausible explanation. Working in a child protection setting involves clinical responsibilities which incorporate advocacy for prevention of harm at either a primary level through public health and education initiatives or at a secondary level by aiming to prevent further harm for already maltreated children through clinical work and interagency discussions. The assessment framework required for these tasks in child protection should be clearly separated from the framework used for forensic evaluation of findings considered suspicious of harm.
2. ***Separate treatment from forensic evaluation in assessment of suspicious childhood injury.*** In child protection it is useful to have distinct separation between the paediatricians responsible for the clinical care of patients and the child protection paediatricians who are responsible for providing forensic opinion to investigating authorities. It is acknowledged however that this may not be possible outside of large tertiary paediatric institutions.
3. ***Restrict opinion to consideration of biomechanics of injury and injury plausibility:*** Restricting injury interpretation to biomechanical factors of force, mechanism of injury and issues of timing alongside using more precise terms to define the relationship between a potential explanation and observed findings such 'possible', 'plausible', or 'probable' is less ambiguous to the professionals who are required to respond to forensic opinions^{20, 44}. Keep an open mind that is independent of SES factors and incorporating psycho-social factors into the basis of forensic opinion. Leave the family assessment to other professionals involved. Whilst the presence of risk factors does not, and should not, result in a conclusion of abuse, their presence should inform decision-making and planning in the setting of uncertainty^{20, 44}. If they are included in a report to inform relevant authorities of risk, the paediatrician should explicitly state they have not been used as a basis of opinion. Do not trespass into the ultimate issue as to whether or not the child has been abused or presume issues of intent. At the end of the forensic medical assessment it may be that a matter remains unresolved or inadequately explained. It is reasonable to then highlight the ongoing risk of future harm for the child which requires careful

professional assessment and risk management. It may also be reasonable to draw parallels to findings in the case that are similar to those involving inflicted mechanisms from existing literature. Do not base opinions of stated injury causation solely on population research. Epidemiological research is helpful to identify suspicion but forensic assessment beyond that point (ie. matters subject to investigation) require consideration of individual factors operating in a specific injury event which limits generalisability from epidemiological research²⁰. Avoid subjective/emotive descriptors and use non-judgemental language in medical records/documentation and in medico-legal reports.

4. ***Adopt a process of active construction of differential diagnoses for individual findings:*** Using and teaching a standardised model using hypothetico-deductive reasoning for forensic assessment of findings considered suspicious of harm will generate 'forward-thinking' rather than reliance on heuristics which involve increased risk of error. Having trainees slow down and 'think aloud' when formulating forensic opinions about suspicious injury may be a useful mechanism to reduce risks of diagnostic bias from faulty heuristics which is of benefit to the teacher and the learner alike. Adopt a forensic approach to reporting imaging of cases subject to child protection investigations that focuses on identification of findings and constructing a differential diagnosis rather than reaching a definitive conclusion about abuse. Tunnel vision may be countered by engaging in critical thinking and using systematic consideration of alternatives.
5. ***Recognise and safely manage uncertainty within the timeline of forensic investigation:*** The extent of forensic opinion required varies depending on the stage at which the expert is asked to contribute an opinion. In an Emergency Department the relevant task for the doctor assessing the child is to determine if the findings are considered suspicious of harm, which may initiate a criminal and child protection investigation. For a forensic/child protection paediatrician subsequently involved, opinion is typically restricted to determining if the initial suspicion of harm is resolved or sustained after forensic medical assessment has been completed, in relation to a matter still subject at that point to ongoing investigation. This opinion is typically issued as an interim report to guide child protection professionals regarding immediate safety/placement decisions and may also be used by investigating police to initiate their criminal investigation²⁰. Further opinion may be required at a later time using information derived from advanced or completed police and statutory investigations. By virtue of experience, some forensic paediatricians may be requested to undertake case reviews of matters subject to investigation where they have not been directly involved. In these cases the investigation is typically complete, remains unresolved and is now subject to a legal process. Medico-legal opinion in the form of a report may be restricted to opinion on specific issues allowing expansion/justification for opinion which may be in greater detail than what was provided by doctors who were directly involved. Pre-trial discussions are useful to ensure evidence is understood and accurately conveyed.
6. ***Incorporate psychology into training in forensic medicine:*** Forensic medical education and certification should include training in psychology that is relevant to forensic work such as experimental methods, aspects of perception, judgment, decision-making and social influence. Expanding on experimental research exploring biases in child protection assessments is also much needed.

7. **Adopt a high level of self-awareness in conducting child protection assessments.** Identify your own individual biases and actively consider the opposite to enhance objectivity. Remain independent of parties that request opinions. Demand all information is made available for review before offering an opinion. Increase involvement in reviewing your own evidence and providing statements of limitations.
8. **Gain experience in giving evidence for both legal sides in cases involving allegations of child abuse.** Develop objective criteria for defining agreement to undertake cases if you have not been directly involved, regardless of whether the request is from prosecution or defense. It is important for paediatricians employed in child protection services to enable access for defense to seek forensic opinions if appropriately qualified. Educate experts and the legal profession that by agreeing to provide an opinion, there should be no obligation that it will necessarily support a case. It may help narrow issues for a subsequent trial, or even enable a matter to be resolved prior to trial if both sides agree on key issues.
9. **Have peer review mechanisms in place, within and external to the institution.**
10. **Ensure strong leadership qualities in peer review processes and case discussions.** This requires a group leader who is participative rather than directive/authoritarian in style, combined with high level skills in recognising and managing negative group dynamics. Seek to disprove opinions by incorporating a devils advocate into case discussions to minimise “groupthink” factors operating.

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Box 1: The Cognitive Continuum.

Heuristics: mental short-cuts, sometimes referred to as “rules of thumb”, used to arrive at a diagnosis, based on pattern recognition and experience. It is intuitive, influenced by recency, bypasses consciousness and may be error-prone due to inherent “blindspots”. Heuristics are readily available, fast and most commonly used in clinical practice.

Hypothetico-deductive reasoning: development of a broad differential diagnosis. This diagnostic method is slower, more commonly used by novices and taught in medical pedagogy.

Typically, experienced clinicians flexibly use both intuitive and hypothetico-deductive methods for clinical reasoning.

Highlights

1. Forensic experts must safely manage uncertainties when interpreting medical evidence.
2. Cognitive and contextual biases can influence reliability of expert opinion.
3. Forensic paediatricians can provide opinion for prosecution or defense if qualified.
4. Forensic assessment must be differentiated from advocacy in medical child protection.
5. Medical opinion should be restricted to biomechanics and injury plausibility.