A critical analysis of medical opinion evidence in child homicide cases

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A critical analysis of medical opinion evidence in child homicide cases

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Recently, appellate courts have reviewed controversial infant homicide cases involving smothering or fatal inflicted head injury. These deaths are difficult to distinguish from accidental or natural deaths. Recurrent intra-family sudden death is regularly classified as smothering. Infant deaths involving a triad of brain and eye injuries are usually attributed to shaking. Examination of medical literature on both types of death indicates there is rarely independent corroboration that suspicion of fatal abuse is accurate. Contentious appellate cases in common law jurisdictions of England and Wales, Australia, and Canada, and judicial and medical regulatory are discussed. Experts were not always impartial nor did they advise courts of significant limitations in infant death investigation. Medical and psychosocial evidence, both of uncertain reliability, were presented as independently corroborative of each other, which is misleading. Rigorous scientific or clinical methods were often absent. Admitting medical evidence, based on specialised training and experience, rather than considerations of its reliability and accuracy, has placed pressure on criminal trial safeguards (cross-examination, rebuttal experts and judicial directions) to reveal evidentiary problems to the jury. Wrongful convictions and dubious verdicts suggest the frailty and failure of safeguards, requiring changes to how courts and prosecutors manage expert evidence in these cases. Incorporating psychological perspectives on expertise, the thesis proposes reliable expertise is difficult to acquire without feedback on accuracy. The thesis explains why expertise and 'specialised knowledge' ought to be judged by drawing on psychological literature, as well as medical and legal discourse; why, the pursuit of a prosecution ought to be seriously questioned when a case involves uncorroborated medical or psychosocial evidence, or there is significant disagreement between experts; and the dangers in relying on unconfirmed medical or psychosocial evidence to legitimise speculative medical opinion in the guise of science or authority is explained. The thesis concludes with suggestions for avoiding future wrongful convictions: greater medical focus on independent verification of cause of death and regulatory oversight of medical testimony and prosecutorial conduct, and reliance on a medical advisory mechanism in cases with serious issues with expert evidence.

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Acknowledgements

No way of thinking or doing, however ancient, can be trusted without proof.
Henry David Thoreau

I am a Clinical Psychologist practicing since 1987. My time at a tertiary level Child Protection Team at The Sydney Children's Hospital, Randwick, Australia brought to my attention the pivotal role of medical opinion evidence in establishing how children sustained injuries, which were sometimes fatal. This thesis began in a Department of Psychology, but I transferred to a Law Faculty. Though I am not a lawyer, the thesis endeavours to examine medico-legal and psychological aspects of sudden unexplained infant deaths. It sets itself the task of addressing important questions requiring rigorous and critical analysis to ensure accuracy and justice is achieved. I hope my thesis sheds light on this complex issue.

Gary Edmond has been a mentor, guide and staunch critic. I am deeply grateful that he trusted a novice to navigate this perplexing field of inquiry. Emma Cunliffe has provided clarity in an area shrouded in uncertainty. Their patience, support and faith have enabled me to crystalise and formulate my fledgling insights into a dissertation.

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My husband, Grant, posed the question that started my journey - 'how do doctors know the injuries were deliberately inflicted?' Through my many doubts and fears, he

maintained a trust in my ability to address this question and helped me return time and again to the seemingly overwhelming task before me. Without him the thesis would not have been achieved. His insistence on evidence and proof has shaped my own critical thinking and is the driving force behind my research. My son, Nick, has inspired me to seek truth and justice, both of which he passionately pursues. If I have achieved a modicum of his vision, I have done well. My mother has placed her faith in my abilities well before they were evident. I owe her a debt of gratitude. For these reasons, the thesis is dedicated to them.

Abbreviations

AHT	Abusive head trauma
ALTE	Acute or apparent life threatening event
ATD	Anthropomorphic test device
CCD	Cerebrocranial disproportion
CESDI	Confidential Enquiry into Sudden Deaths in Infancy
SUDI	Sudden Unexplained Deaths in Infancy
CONI	Care of Next Infant Programme (England)
CPR	Cardio-pulmonary resuscitation
CSF	Cerebrospinal fluid
CT	Computerised axial tomography (also called CAT scan)
DAI	Diffuse axonal injury
EBM	Evidence-based medicine
HIE	Hypoxic ischemic encephalopathy
iTBI	Inflicted traumatic brain injury
ICP	Intracranial pressure
IDH	Intra-dural haemorrhage
MCAD	Medium-chain acyl-coenzyme A dehydrogenase deficiency
MRI	Magnetic resonance imaging
MSbP	Munchausen Syndrome by Proxy
NAHI	Non-accidental head injury
NRC	National Research Council
PSDH	Perinatal subdural haemorrhage
RH	Retinal haemorrhage

SBS	Shaken baby syndrome
SDH	Subdural haemorrhage
SIDS	Sudden infant death syndrome
SIS	Shaken impact syndrome
SUDEP	Sudden and unexpected death in epilepsy
SUDI	Sudden unexplained death in infancy
TAI	Traumatic axonal injury

Glossary of Medical Terms

Anaemia	A deficiency in the number or quality of red blood cells or haemoglobin in the blood.
Apnoea	Temporary absence or cessation of breathing.
Arachnoid mater	One of the three meninges covering the brain and spinal cord. It is interposed between the dura and pia mater. It is separated from the pia mater by the subarachnoid space.
Artery	The blood vessels that carry oxygenated blood from the heart to the body's tissues.
Arterial hypertension	Hypertension is high blood pressure, which is the force of blood pushing against arterial walls as it flows through arteries.
Asphyxia	An extreme reduction in the amount of oxygen in the body with an increased concentration of carbon dioxide leading to loss of consciousness or death. Asphyxia can be induced by choking, drowning, electric shock, injury, or the inhalation of toxic gases. It is a complicated term and used in different ways by different authors in different contexts.
Aspiration pneumonia	Pneumonia caused by breathing in or aspiration of foreign material into the lungs, usually gastric contents.
Asthma	A chronic, long-lasting inflammatory disease of the airways. The inflammation causes the airways to spasm and swell periodically causing a narrowing of airways. The individual then needs to wheeze or gasp for air.
Autopsy	Examination of a cadaver to determine or confirm the mechanical, medical and manner of cause of death and to assist in recreating the circumstances of death. Also called post-mortem or post-mortem examination.
Biochemical	The chemical composition of a particular living system or biological substance.

Bridging veins	The brain is attached to the skull with bridging or connecting veins. These veins move blood from the brain to the dural sinuses.
Capillary	One of minute vessels connecting arterioles (artery branch) and venules (small vein joining capillaries to a larger vein), the walls of which act as semi-permeable membrane for the interchange of substances between the blood and tissue fluid.
Cardiac Dysrhythmias	Relating to the heart. Any abnormality in the rate, sequence or regularity of cardiac activation. Also called cardiac arrythmia.
Cerebral oedema	Brain swelling caused by increased volume of extra-vascular compartment from the uptake of water in the grey and white matter in the brain.
Cerebral haemorrhage	Bleeding into the brain.
Cerebral venous hypertension	High blood pressure in the veins of the brain.
Cerebral venous congestion	An abnormal accumulation of blood in the veins in the brain.
Cerebrocranial disproportion	Refers to the swollen oedematous cerebrum requiring a larger space than the semi-rigid infant cranium can provide.
Cerebrospinal fluid	A clear bodily fluid that occupies the subarachnoid space and the ventricular system around and inside the brain and spinal cord. The brain 'floats' in the fluid, which occupies the space between the arachnoid and pia mater. The fluid constitutes the content of the intra-cerebral ventricles, as well as the central canal of the spinal cord. It acts as a buffer for the cortex (outermost layer of the brain) that provides mechanical and immunological protection to the brain inside the skull.
Cerebrum	The main part of the brain that occupies the upper part of the cranial cavity. Its two hemispheres are united by the corpus callosum and form the largest part of the central nervous system.

Coagulopathy	A defect in the body's mechanism for blood clotting, causing susceptibility to bleeding. Also called clotting disorder and bleeding disorder.
Colic	Persistent and unexplained crying in healthy infants aged between 2 weeks and 5 months.
Computerised axial tomography	An imaging technique using computer-processed X-rays to produce tomographic images (of body sections via penetrating waves) or 'slices' of specific areas of the body. Digital geometry processing generates a three-dimensional image of the inside of the body from a large series of two-dimensional X-ray images taken around a single axis of rotation. These cross-sectional images are used for diagnosis and treatment.
Congenital viscero-autonomic dysfunction	Dysfunction in the viscera – the soft internal organs, especially within the abdominal and thoracic (part between the neck and diaphragm, encased by the ribs) cavities, and the autonomic nervous system – the peripheral nerves that carry brain signals and control involuntary body functions, such as the beating of the heart.
Connective tissue disorders	Tissue that connects, supports, binds or encloses the structures of the body. Connective tissues are made up of cells embedded in an extracellular matrix and include bones, cartilage, mucous membranes, fat and blood. Disorders in connective tissue include those caused by vitamin deficiencies and depletions.
Cranial suture	Line of junction between two bones in the cranium.
Cranium	The components comprising that part of the skull that is a bony enclosure for the brain.
Dehydration	The loss of water and salts necessary for normal body function.
Diffuse axonal injury	One of the most common and devastating types of brain injury, in which damage occurs over a more widespread area than in focal

	brain injury. It refers to extensive lesions in white matter tracts, is one of the major causes of unconsciousness and persistent vegetative state after head trauma. Diffuse axonal injury is not only caused by trauma and is difficult to distinguish from cerebral anoxia/hypoxia. In cases of trauma, such as shaking, hypoxia/anoxia can be present. However, the distribution of the axonal injury through the brain is different when purely due to trauma compared to hypoxia/anoxia.
Diffuse falcine intra-dural haemorrhage	Widespread bleeding in the falx, a very thin layer of tissue/fold of dura mater separating the two hemispheres of the brain.
Dura mater	The outermost of three layers of the meninges surrounding the brain and spinal cord, and is responsible for containing the cerebrospinal fluid.
Dural capillary plexus	A vascular structure in the form of a network.
Encephalopathy	Degeneration of brain function caused by any of various acquired disorders, including metabolic disease, organ failure, inflammation, and chronic infection. Also called diffuse brain disease.
Epilepsy	A disorder of the central nervous system characterised by periodic loss of consciousness with or without convulsions.
Fluid-electrolyte derangement	A disorder of water and electrolyte balance. Electrolytes maintain homeostasis (stability) within the body. They help to regulate many functions including myocardial and neurological function, fluid balance, oxygen delivery, and acid-base balance.
Foetal	Pertaining to, or characteristic of, or being a foetus.
Foetus	The unborn young from the end of the eighth week after conception to the moment of birth, as distinguished from the earlier embryo.
Fontanel	The soft membranous gap between the incompletely formed cranial bones of a foetus or an infant.

Fovea	The area of the retina through which the central visual axis of the pupil falls.
Haemodynamic disorders	Disorders in the movement of blood, such as venous hypertension, systemic arterial hypertension, or episodic surges of blood.
Haematoma	Is the extravasation of blood outside the blood vessels, usually after a haemorrhage. A haematoma is a pocket or localised collection of blood in liquid form within the tissue.
Haemorrhage	The loss of blood from the circulatory system.
Haemoglobin	Iron-containing oxygen-transport metalloprotein in the red blood cells.
Histrionic Personality Disorder	A psychological disorder characterised by excessive emotionality and attention-seeking behaviour.
Hydrocephalus	A build-up of fluid inside the skull leading to brain swelling. Hydrocephalus occurs when there is an abnormal accumulation of cerebrospinal fluid within the brain leading to swelling of the brain. If this occurs before the cranial sutures are closed, the head may enlarge, with associated damage to brain tissue.
Hypoxia	Decreased oxygen.
Hypoxic brain damage	Brain damage caused by deficiency in the amount of oxygen delivered to the brain.
Hypoxic-ischemic	A term which reflects the difficulty in distinguishing between brain damage due to decreased oxygen in the blood and damage due to decreased blood being delivered to the tissues.
Hypoxic-ischemic encephalopathy	A condition in which the brain has an insufficient supply of oxygenated blood supply caused by constriction or obstruction of blood vessels.

Inflammatory disorders	A large group of disorders underlying many disease states and often involving the immune system. Inflammatory disorders can also be involved in many non-immune diseases, such as heart disease and cancer.
Influenza	An infectious disease caused by viruses.
Intracranial pressure	The pressure inside the skull and thus the brain tissue and the cerebrospinal fluid. Volume changes in any constituent of the cranium can change intracranial pressure.
Intradural vascular plexus	Network of nerves and blood vessels within the dura mater.
Intubate	The insertion of a tube into the trachea to assist breathing.
Ischemic injury	A restriction or thinning of blood supply to tissues causing a shortage of oxygen and glucose required for cellular metabolism, which keeps tissues alive. It is usually caused by problems with blood vessels and arteries, particularly obstruction, resulting in tissue dysfunction or damage. Irreversible brain and heart tissue damage can occur within 3 – 4 minutes.
Klebsiella septicaemia	Septicaemia refers to presence of pathogens in the bloodstream, which causes sepsis. Klebsiella is a bacterial strain that causes septicaemia.
Lesion	Any abnormal tissue found on or in an organism, usually damaged by disease or trauma.
Macroscopic intradural haemorrhage	Bleeding within the dura mater that is visible to the naked eye.
Macula	The macula surrounds the fovea in the retina. It is a yellow highly pigmented spot in the center of the retina.

Magnetic resonance imaging	A medical imaging technique used to visualise internal structures of the body in detail. This technique uses nuclear magnetic resonance to obtain images of nuclei atoms within the body. Compared to CT scans or X-rays, MRI yields a better contrast between the body's soft tissues and is particularly useful in imaging the brain, muscles and heart, and cancers.
Meninges	The membranes that cover the brain and spinal cord.
Metabolic disorders	A large number of disorders caused by blockage or disruption to an essential pathway in the body's metabolism. Metabolism refers to the breaking down of food into simpler components – proteins, carbohydrates or sugars, and fats.
Myocardial	Pertaining to the muscular tissue of the heart (the myocardium).
Myocarditis	An inflammatory disease of the myocardium from a variety of causes. Most cases are due to viral infection but toxins, drugs and hypersensitive immune reactions can also be the cause.
Neonatal respiratory distress syndrome	A condition commonly seen in premature infants in which there is difficulty with breathing due to insufficient development of surfactant production and structural immaturity in the lungs. Surfactant is a protective substance which helps lungs to inflate with air and keeps the air sacs from collapsing.
Ocular	Pertaining to the eye.
Ophthalmology	Branch of medicine dealing with the physiology, anatomy and diseases of the eye.
Osteogenesis imperfecta	A genetic bone disorder causing extremely fragile bones.
Oxygenate	The process of supplying, combining or impregnating with oxygen.

Pathology	The branch of medicine concerned with the cause, origin, and nature of disease, including the changes occurring as a result of disease.
Paediatric	Of or relating to the medical care of children.
Perinatal	The period immediately before and after birth.
Perfuse	To force blood or other fluid to flow from the artery through the vascular (blood vessels) bed of a tissue or to flow through the lumen (cavity or channel) of a hollow structure.
Perimacular retinal folds	The multiple layers of the retina.
Petechial haemorrhages	Bleeding under the skin that occur in minute spots.
Pia mater	The delicate, innermost layer of the meninges surrounding the brain and spinal cord.
Pneumonia	A lung infection caused by many organisms causing infection, including fungi, bacteria, viruses, parasites and amoebae.
Pyloric stenosis	A narrowing of the passage between the small intestine and the stomach. Usually this condition affects infants in the first weeks of life and can be corrected with surgery.
Retina	The multi-layered, inner lining of the eye which has a layer of light-sensitive tissue on the back wall of the eye. It translates what we see into neural impulses that are sent to the brain via the optic nerve. The posterior pole of the retina encompasses the major blood vessels, the macula, the fovea, and the optic nerve head (the optic disc).
Retinal haemorrhage	A disorder of the eye in which bleeding occurs into the retina. Retinal hemorrhages can be caused by injuries, usually forceful blows to the head during accidents and falls, as well as by adverse health conditions.

Retinal vein	A short vein that runs through the optic nerve and drains blood from the capillaries of the retina into the larger veins outside the eye.
Seizure	A sudden episode of transient neurological signs, such as involuntary muscle movements, sensory disturbances, and altered consciousness. Seizures are caused by abnormal electrical activity in the brain.
Seizure disorders	Any of various neurological disorders characterised by sudden, recurrent attacks of sensory, motor, or psychic failure with or without loss of consciousness or convulsive seizures.
Sepsis	Widespread infection.
Staphylococcus aureus	A bacteria that commonly causes disease.
Subdural	Below the dura mater but above the subarachnoid space of the meninges.
Subdural haemorrhage	Is a type of traumatic brain injury in which blood gathers between the dura and arachnoid mater. The bleeding usually results from tears in bridging veins that cross the subdural space. Usually intracranial pressure increases, causing compression of and damage to delicate brain tissue. Also known as subdural haematoma.
Suffocation	Interruption or cessation of breathing with oxygen deprivation, usually caused by an obstruction of the airways.
Thrombotic disorders	There are many types of thrombotic disorders. Thrombus (plural is thrombi) is a stationary blood clot along the wall of a blood vessel. Thrombi can obstruct blood flow at the site of formation or detach and become an embolism that blocks a distant blood vessel.
Vascular anomaly	A localised defect in blood vessels that can effect any aspect of the vasculature.

Vasculature	Pertains to the capillaries, arteries, veins and lymphatic system.
Vein	A vessel within which blood flows towards the heart, in the systemic circulation carrying blood that has expended most of its oxygen.
Venous	Pertaining to the blood in the pulmonary artery, right side of the heart, and most veins, that has become low in oxygen and charged with carbon dioxide during its passage through the body making it usually dark red. Also pertaining to the veins.
Viral infection	An infection caused by a virus.
Virus	A germ that is smaller than bacteria. Viruses have a protective coating making them more difficult to kill than bacteria. Viruses cannot grow or exist without host cells, typically living in organisms, such as humans.
Vitamin C deficiency	Vitamin C is needed for the synthesis of collagen. Deficiency in vitamin C causes scurvy, which is characterised by malaise and lethargy, followed by spots on the skin, spongy gums and bleeding from mucous membranes.
Vitamin K deficiency	A form of avitaminosis resulting from insufficient vitamin K_1 or K_2 or both. Avitaminosis is any disease caused by chronic vitamin deficiency or a defect in metabolic conversion.

Abstract

A critical analysis of medical opinion evidence in child homicide cases

There is no doubt that some parents or carers kill infants in their care. However, the prosecution of an individual for homicide ought to be based on reliable and accurate evidence of guilt. Recently, appellate courts have reviewed controversial infant homicide cases involving smothering or fatal inflicted head injury. These deaths are difficult to distinguish from accidental or natural deaths. Recurrent intra-family sudden death of infants and toddlers has, in a number of cases, been regarded as due to smothering. Infant deaths involving a triad[1] of brain and eye injuries are usually attributed to shaking. Examination of medical literature on both types of death indicates there is rarely independent corroboration that suspicion of fatal abuse is accurate. Contentious appellate cases in common law jurisdictions of England and Wales, Australia, and Canada, and judicial and medical regulatory are discussed. Experts were not always impartial nor did they advise courts of significant limitations in infant death investigation. Medical and psychosocial evidence, both of uncertain reliability, were presented as independently corroborative of each other, which is misleading. Rigorous scientific or clinical methods were often absent. Admitting medical evidence, based on specialised training and experience, rather than considerations of its reliability and accuracy, has placed pressure on criminal trial safeguards (cross-examination, rebuttal experts and judicial directions) to reveal evidentiary problems to the jury. Wrongful convictions and dubious verdicts suggest the frailty and failure of safeguards, requiring

[1] The 'triad' refers to a constellation of signs in suspected SBS death. The three signs are retinal and sub-dural haemorrhages, and hypoxic-ischaemic encephalopathy.

changes to how courts and prosecutors manage expert evidence in these cases. Incorporating psychological perspectives on expertise, the thesis proposes reliable expertise is difficult to acquire without feedback on accuracy. The thesis explains why expertise and 'specialised knowledge' ought to be judged by drawing on psychological literature, as well as medical and legal discourse; why the pursuit of a prosecution ought to be seriously questioned when a case involves uncorroborated medical or psychosocial evidence, or there is significant disagreement between experts; and the problems inherent in relying on unconfirmed medical or psychosocial evidence to legitimise speculative medical opinion in the guise of science or authority is explained. The thesis concludes with suggestions for avoiding future wrongful convictions: greater medical focus on independent verification of the mechanical cause of death[2]; and regulatory oversight of medical testimony and prosecutorial conduct, and reliance on a medical advisory mechanism in cases with serious issues with expert evidence.

[2] The term 'cause of death' in the thesis refers the mechanical and medical cause of death. See pages 1-2 for elaborated discussion.

Table of Contents

Introduction

Overview of thesis

This thesis examines problems with medical opinion evidence uncovered in recent controversial criminal appellate judgments relating to filicide. Homicide refers to the unlawful killing of another human being, while filicide refers to a form of homicide in which the parent kills his or her own child. As there are differences in reporting and classification systems for filicide, filicide rates are difficult to ascertain accurately.[3] Estimated rates of filicide vary between 0.6 per 100,000 children under 15 years to 2.5 per 100,000 children under 18.[4] Filicide is, therefore, a rare event, even though actual rates of filicide are difficult to estimate. There is, however, evidence internationally that children less than 12 months old are at higher risk of filicide than any other age group.[5] Compared to other developed nations, the U.S. has the highest rate of filicide for infants less than 12 months, estimated to be 8 per 100,000.[6] Notably, variations in reporting, even amongst developing countries, mean that comparisons of a rare and controversial category, such as filicide, are unlikely to be reliable.

The prosecution of filicide cases relies heavily on medical opinion evidence on cause of death. In pathology, 'cause of death'[7] is a complex term that needs to be defined

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[3] Flynn, S, Windfuhr, K, and Shaw, J, 'Filicide: A literature review' *The National Confidential Inquiry into Suicide and Homicide by People with Mental Illness Centre for Suicide Prevention* (The University of Manchester, 2009).
[4] Jason J, Gilliland, J.C, and Tyler, C.W Jr, 'Homicide as a cause of pediatric mortality in the United States' (1983) 72 *Pediatrics* 191-197; Somander, L.K, and Rammer, L.M, 'Intra- and extra-familial child homicide in Sweden 1971–1980' (1991) 15 *Child Abuse & Neglect* 45-55.
[5] Friedman, S.H, Holden, C, Hrouda, D.R, and Resnick, P.J, 'Maternal Filicide and Its Intersection with Suicide' (2008) 8 *Brief Treatment and Crisis Intervention* 283-291.
[6] Ibid.
[7] Cordner, S, personal communication, 2013.

at the outset. The different elements of this phrase consist of the *medical* cause of death (a condition, disease or injury causing death) and the *manner* of death (homicide, accident, suicide or natural). In addition, in pathology, the *mechanism* is the means by which the manner of death impacted the medical cause. For example in an assault case, the mechanism (crow bar) was the means by which the manner (homicide) resulted in the cause of death (fractured skull and traumatic brain damage). In SUDI, this means the mechanism (smothering, shaking) led to the medical cause of death (fatal injury), which affected the classified manner (homicide) in which the death occurred. The pathological definition of 'manner' is then, arguably, a socio-legal construct, although pathologists incorporate it as part of the cause of death. The thesis primarily concentrates on the mechanism and medical cause of death.

The appellate cases considered in this thesis involve two controversial types of sudden unexpected death in infancy (SUDI): one is smothering and the other is death from head injuries. Part of the medical investigation of cause of death in these cases depends on distinguishing between death from deliberately inflicted mechanisms, which constitutes filicide, and death from other known medical causes. In order to prove deliberate smothering, a medical investigation must establish that the death is not a case of Sudden Infant Death Syndrome (SIDS). In the case of head injury deaths, the task is to determine whether death was due to accidental factors or the non-accidental mechanism of shaking, with or without impact type head injury (Shaken Baby Syndrome (SBS)). As these types of death are rare and, usually there is no independent corroboration of the mechanism of death, it is difficult for physicians to factually know whether the ascertained medical or mechanical cause of death is accurate. Under these conditions, it is difficult, perhaps impossible, for physicians to develop reliable expertise, which ultimately consists of making correct decisions. The thesis proposes

that problems with acquisition of expertise affect the reliability of medical opinion evidence about SUDI, which then influences the reliability of medical evidence in criminal trials for SUDI. In the United Kingdom and Australia, the physicians typically involved with death investigations are forensic pathologists and child protection paediatricians. There are very few paediatric forensic pathologists and, in Australia, no one is employed full-time as a paediatric forensic pathologist.

In three leading Commonwealth common law jurisdictions, England and Wales, Canada, and Australia, appellate courts have presided over appeals from conviction for murder or manslaughter of infant(s), either due to multiple intra-family SUDI or head injury deaths. The thesis examines controversial cases that have come before appeals courts in the last two decades in which the reliability and accuracy of medical opinion evidence has been a central concern. The influential English cases are: *Clark*, *Canning*, *Anthony*, *Kai-Whitewind*, *Harris, Rock, Cherry and Faulder*, *Henderson, Butler & Oyediran*.[8] In Australia, the cases are *Phillips*, *Folbigg* and *Matthey.*[9] In Canada two recent cases are *Sherret-Robinson* and *Marquardt*.[10] The thesis examines current medical knowledge about death investigation in the two types of death and appellate court responses to appeals based on medical expert evidence drawing extensively from these cases. The key purpose is to examine medical and related legal factors associated with wrongful convictions.

The medical investigation of infant death, and resulting medical opinion evidence, is the primary focus of the thesis. Psychosocial and psychiatric factors – such

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[8] *R v Clark* [2003] EWCA Crim 1020 (11 April 2003); *R v Cannings* [2004] EWCA Crim 1 (19 January 2004); *R v Donna Anthony* [2005] EWCA Crim 952; *R v Kai-Whitewind* [2005] EWCA Crim 1092; *R v Harris, Rock, Cherry and Faulder* [2005] EWCA Crim 1980; *R v Henderson, Butler & Oyedir*an [2010] EWCA Crim 1269.
[9] *R v Phillips* [1999] NSWSC 1175; *R v Folbigg* [2003] NSWSC 895; *R v Matthey* [2007] VSC 398.
[10] *R v Sherret-Robinson*, 2009, ONCA 886; *R v Tammy Marquardt*, 2011, ONCA 281.

as relationship and mental health status, bonding with the infant, economic and social stress – are often present in the context of death investigation. Typically, forensic pathologists would agree these elements should not be taken into account in medical investigation of death. However, the difficulty is that consideration of these factors might, unconsciously, affect medical judgment. These factors will be discussed briefly, but are worthy of research focus in their own right. Thereafter, the thesis will examine the circumstances that assist the development of medical expertise and the underlying, often unconscious, psychological aspects of medical decision-making that can introduce error. The thesis then examines medical and judicial regulatory responses to the professional conduct of medical experts in SUDI trials. These inquiries suggest that medical opinion evidence in SUDI has not been subjected to the scrutiny it deserves, given the significant and pervasive effects on the accused (and their other children and family) of misleading opinion evidence. Lastly, the thesis examines the laws of evidence and legal safeguards relevant to expert testimony in criminal trials, highlighting procedural problems in legal management of expert evidence that contributes to wrongful convictions or highly contentious verdicts.

A core evidentiary issue in these cases is the reliability and accuracy of medical opinion evidence on cause of death. Reliability,[11] as used in this thesis, refers to the extent to which opinion evidence represents factual truth, or, in legal terms, is trustworthy. The basic epistemological quandary in these deaths is differentiating cause

[11] The definition of reliability varies between disciplines. Before determining reliability, it needs to be established that the measurement or opinion is a factually correct or a valid measure of the construct in question. Once validity is established, the question of reliability can be addressed. In statistics and psychological measurement, reliability refers to the extent to which a measure is consistent or stable across time and produces similar results when measured repeatedly, indicating that the measurement is accurate. Reliability can also refer to whether the evidence or observation is trustworthy, which is its typical use in law.

from effect, as signs or findings at autopsy may not elucidate the mechanical cause of death. Both SIDS and SBS refer to signs or outcomes rather than causes. In medicine, the term syndrome is often used because the cause is not known. The situation is complicated by the fact that signs or characteristics in these deaths may not be specific to inflicted deaths. This is an area in which finding reliable and accurate evidence of inflicted death is a difficult task. The issue is further complicated by the presence of unreliable non-medical (usually psychosocial) evidence such as maternal mood, quality of relationship with their partner, bonding with the infant, life stresses and so on. A combination of errors in interpretation of medical and non-medical evidence of an infant's death underpins wrongful convictions. The medical research and knowledge on SIDS/smothering and SBS/triad deaths will be examined in Section I, Chapters 1 and 3, respectively.

Appellate courts in England and Wales have quashed the convictions of several mothers whose prosecution relied heavily on medical evidence on the meaning of recurrent SUDI.[12] In Canada, concerns about the reliability of infant death investigation in SUDI conducted by Dr Charles Smith, the chief forensic pathologist in Ontario resulted in a judicial inquiry by Justice Goudge, which in turn led to several convictions being referred to the Attorney General for review.[13] Smith's opinion evidence in head injury cases was particularly concerning in terms of its influence on criminal cases. There have been judicial enquiries in the UK into expert evidence.[14] In Australia, a

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[12] Ibid, n 8.
[13] Kennedy, H. (Chair) *Sudden unexpected death in infancy: A multi-agency protocol for care and investigation*. (The Royal College of Pathologists and The Royal College of Paediatrics and Child Health, 2004); Goudge, S.T, The Hon Justice, *Report into the Inquiry into Paediatric Forensic Pathology in Ontario* (The Commission, Toronto, 2008) 1 & 2, http://www.goudgeinquiry.ca viewed 26 March 2010.
[14] Ibid, Kennedy.

mother was convicted and incarcerated for 30 years for murdering her four infants, a conviction that has been questioned,[15] but in another similar case, the majority of the medical evidence was excluded at the pre-trial hearing after which the Crown abandoned proceedings.[16] The way in which the judiciary responds to and manages conflicting expert opinion is a central issue in these appeals. The cases also demonstrate that, in the absence of reliability standards for the admission of medical opinion evidence, the judiciary has informally developed its own methods for evaluating this type of evidence. It will be argued that the judiciary seems to favour clinical opinion evidence – that is, the opinion of experts who rely on their practical experience with death investigations. The resolution of conflicting opinion evidence seems to rest on factors such as credentials, presentation, general acceptance and extent of consensus between experts, rather than an assessment of the reliability or accuracy of the content of the expert's evidence. This is not surprising, as judges are not required to assess the reliability of expert evidence, only whether the evidence conforms to relevant rules for admission. This thesis draws on debates in law and medicine and the judgments of appellate courts. These sources reveal the difficulty medicine experiences in reliably and accurately investigating infant death and legal problems with managing medical opinion evidence in SUDI trials. Appellate cases relating to SIDS/smothering and SBS/triad deaths will be discussed in Section I, Chapters 3 and 5, respectively.

The changing nature of medical evidence from case-based observations to the seemingly more objective stance promoted by evidence-based medicine (EBM) will be briefly reviewed. EBM is closely tied to concerns about the reliability of medical opinion

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[15] Cunliffe, E, *Murder, Medicine and Motherhood.* (Oxford: Hart Publishing, 2011).
[16] Ibid n 9, *Matthey*, 140.

evidence based on clinical practice, which is a particular vulnerability in child abuse paediatrics and SUDI investigation. Specific effects of various research designs and the impact on the quality of evidence derived from research will be discussed in the section on SBS/triad deaths.[17] Both clinical and practical experience derived opinion and EBM approaches are necessary in death investigations, and may be able to be adapted to the goals of the criminal justice system. Section I will begin with an examination of paediatric forensic pathology and child protection paediatrics, followed by developments in medicine from clinical knowledge to EBM.

Medical opinion evidence is typically clinical in nature. It is important to emphasise that historically much has been made of clinical experience in medical and legal approaches to SUDI, however:

> *The clinician, no matter how venerable, must accept the fact that experience, volumous [sic] as it might be, cannot be employed as a sensitive indicator of scientific validity…* [18]

This quote from Bernard Fisher, an eminent researcher and clinician in breast cancer, encapsulates an innate tension in medicine between clinical (or practically acquired) knowledge and knowledge derived from scientific research, such as the Cochrane hierarchy.[19] The two types of knowledge are interconnected. Scientific research applies scientific principles to clinical problem solving. As the following discussion will demonstrate, the judiciary has a tendency to value clinical experience and, arguably, is biased towards clinical opinions as reliable evidence of an issue in question – this may

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[17] See Section I, Chapter 4 for a review of medical research in SBS.
[18] Fisher, B, 'A Commentary on the role of the surgeon in primary breast cancer' (1981) 1 *Breast Cancer Research & Treatment* 17-26 (23).
[19] See Cochrane hierarchy of research, Mulrow, C.D, and Oxman, A.D, (eds) (1997) 4 *Cochrane Collaboration Handbook*. In The Cochrane Library, Oxford, Updated Software.

be due to regard for authority and relatively limited understanding of scientific research methods – however, this contains problems with determining the reliability of clinical opinion evidence, not the least of which is potential bias[20] in selection and interpretation of cases. The medical community is divided as to which type of knowledge (clinical versus other forms of systematic knowledge) is more reliable. This creates a tension with proponents of clinical experience believing that direct, ongoing involvement with patients shapes and improves physicians' knowledge; whilst those advocating for a greater focus on scientific knowledge in medical decision-making are particularly concerned with eliminating sources of bias (especially confirmatory bias which is a vulnerability in clinical settings) and reducing error in medical knowledge. In practice, most physicians develop opinions based on both forms of knowledge. The reliability of medical opinion about an infant's death depends on the quality of the clinical and research experience and knowledge on which it is based. Systematic knowledge based on corroboration is an essential foundation for reaching reliable opinions.

In SUDI investigation, the accuracy of a diagnosis is unclear as physicians are essentially relying on subjective, clinical opinion rather than independent corroboration of their opinion. There is considerable disagreement between reputable experts in interpreting autopsy results and deciding whether a death is due to smothering or shaking, reflecting the uncertain and potentially unreliable evidentiary basis upon which inferences are made in death investigations.[21] Arguably, the extent of disagreement constitutes

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[20] Bias refers to an unjustified tendency to hold a particular view at the expense of other alternatives. A bias, therefore, tends to be one-sided and lacks neutrality. Cognitive biases refer to a human tendency to make decisions based on cognitive factors, which are often unconscious, instead of evidence. Biases can arise from errors due to memory, social attribution, and statistical errors that are difficult to detect. Cognitive biases are common in human judgment and tend to skew the reliability of evidence. See generally, Sternberg, R.J, *Cognitive Psychology* (Thompson Wadsworth, 2006).

[21] Byard, R.W, and Krous, H.F, 'Suffocation, shaking, or sudden infant death syndrome: Can we tell the difference?' (1999) 35 *Journal of Paediatrics and Child Health* 432-433.

reasonable doubt for the purposes of criminal trials, unless there is other compelling evidence of guilt.

In order to provide a framework for the appellate judgments, the thesis examines current medical research and discourse on SBS and SIDS. The analysis reveals that much of the research is based on observational or descriptive studies, which indicate whether certain signs are correlated with the assumed cause, inflicted mechanism of injury and death. However, this type of research does not address the critical question in SUDI investigation: whether there is a causal relationship between signs and the proposed mechanism of injury, shaking or deliberate smothering. Opinions about the mechanism of death are based on inferences from autopsy findings, based on the expert's clinical experience and research. Typically, the testimony provided is clinical opinion evidence, which is of unknown reliability and accuracy. In the absence of medical and legal assessment of reliability, it seems that agreement between physicians in the field is the main type of analysis undertaken by both medical and legal participants in SUDI discourse. However, the medical community is not in agreement about its ability to reliably and accurately detect and prove SBS and smothering. In consequence, assertions by medical experts about the mechanical cause of death need to be carefully scrutinised for reliability and accuracy before admission to criminal proceedings. The difficulty is that there is no formal requirement for judges to assess the reliability of expert opinion evidence. In order to properly guide courts in assessing reliability, attention to research within the medical community is paramount, rather than an adherence to accepted or authority-driven positions displaced from research. The appellate cases also demonstrate that experts have failed to properly inform courts of the limitations of their evidence. The combination of medical and legal failure to assess evidentiary reliability and accuracy underpins the errors identified in the appellate judgments. Judicial inquiries

have attempted to improve the standard and tests applied to medical opinion evidence in response to specific cases in the UK and Canada. However, the concern about the quality of expert evidence is not specific to particular pathologists, such as Charles Smith, or jurisdictions. Rather, errors due to admission of and reliance placed on unreliable medical opinion evidence or evidence of unknown reliability is a danger in *all* cases of SUDI tried in criminal proceedings.

The problem with the notion of covert filicide is that it is only a suspicion when there is no independent corroboration of the mechanical cause of death. Certain signs raise suspicions of filicide, although it is not clear that these signs reliably and accurately differentiate between imposed airways obstruction (deliberate smothering) or shaking (the triad) and other causes of death. The thesis will argue that so-called confirmed cases of filicide are merely *suspected*, rather than *proven*, deaths. This type of opinion is essentially a case description approach, in the vein of Hippocrates' teaching, and is vulnerable to confirmatory bias and distorted appraisal of evidence - in line with the expert's prevailing theory of the mechanical cause of death (confirmation bias).

An unresolved issue in SUDI is what actually constitutes proof of filicide. Medical opinion evidence that filicide can be detected in a reliable and accurate manner has rested on the circular argument that a death constitutes filicide because *other* parents had been convicted in the past on the basis of similar case facts as the particular case in question. For example, in so-called shaken baby cases, parents whose child presents with retinal haemorrhages (RH) and subdural haemorrhages (SDH) are accused of inflicting the injuries because, in the vast majority of cases, parents of children with RH and SDH

are convicted of causing shaken baby syndrome.[22] Similarly, Professor Sir Roy Meadow, a renowned English paediatrician and expert on child abuse and filicide who gave evidence in the *Clark*, *Cannings*, and *Anthony* trials, argued that 'the likelihood that the court verdicts about parental responsibility for [causing their children's death] were correct was very high indeed', without making clear that it was his expert opinion that recurrent SIDS was 'murder unless proved otherwise' that had been a major factor in securing those convictions.[23] This is not only circular reasoning but also a case of an unreliable and self-fulfilling medical and legal evidentiary process confirming itself. Convictions are not independent corroboration of homicide.

The need for evidentiary reliability equally applies to non-medical evidence associated with a criminal case of filicide. During death investigation and trial, medical evidence pertaining to SUDI cases is embedded in a framework of other, often circumstantial, case evidence - much of this is of uncertain value. Psychosocial and psychiatric factors often form part of criminal trials, being adduced as evidence of guilt. Psychosocial factors include maternal depression, bonding and attachment issues, relationship dysfunction, substance abuse, and low income. The extent to which these factors affect medical investigation of an infant's injuries or death is unclear. When the prevalence of these factors are considered, it is clear that, while parents who kill their infants have some of these characteristics, most parents with one or all of these features do not harm or kill their infants. Therefore, the inculpatory meaning of these factors, especially in a particular case where there is suspicion of filicide, is uncertain, as these

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[22] Hobbs, C.J, and Hayward, P.L, 'Childhood matters' (1997) 314 *British Medical Journal* 622-27; Lucks, A.L, Walker, S.G, and O'Callaghan, F.J.K, 'Shaken impact syndrome' (2001) 357 *Lancet* 1207.
[23] Meadow, R, 'Suffocation, recurrent apnoea, and sudden infant death' (1990) 117 *The Journal of Pediatrics* 351-357.

factors cannot provide a reliable basis for discrimination between those who have committed filicide and those who have not. Psychosocial factors associated with SUDI and their prejudicial use will be briefly reviewed in Section I, Chapter 6.

An important underlying aspect of medical opinion evidence is the role of psychological processes and their potential to affect opinion reliability, often unconsciously, by influencing expert judgment and decision-making. Bias is an integral part of human cognition and one that affects clinical judgment as much as any other type of thinking. The risks of misattributing mechanical cause of death when an expert adopts an unquestioning stance in infant death investigations are high. This is especially so for medical experts who are renowned for their apparent ability to detect covert filicide and child abuse. The very fact that an expert is seen to have unique skills for detecting filicide means that, from the point of referral to the expert by other specialists, there is considerable danger for error based on confirmatory bias and uncritical appraisal of their hypotheses regarding cause of death. Under these conditions, the chances of a false positive occurring are high due to the (unjustified) belief that covert filicide exists and can be reliably detected by the expert. The review of the current medical literature on smothering/SIDS and SBS/triad deaths will demonstrate that suspicions, as opposed to independent proof, of filicide characterise research and clinical understanding of these types of death. As the mechanical cause of death is 'diagnosed' by those who believe these events are covert, there is an almost inevitable risk that their interpretation of the case evidence, both medical and psychosocial, and inferences based on this evidence, will be biased towards confirming their belief that the case constitutes filicide. Confirmatory bias is a particular vulnerability in conditions of uncertainty and catastrophe, which compromises the ability to assess all evidence with an open mind that considers alternative explanations. These biases may be unconscious, meaning they can

be difficult to detect and change. The lack of independent verification of the mechanical cause of death means that there is no feedback mechanism to help the expert, in clinical or research settings, to modify his or her judgment when errors are made. In order to develop medical knowledge of sufficient reliability to support the criminal standard of proof, independent verification is essential, as is critical analysis of the reliability of evidence upon which medical opinion is based.

The nature of expertise and psychology of experts is relevant to understanding medical opinion evidence. Developing expertise in an area depends on practice and experience with the subject matter, as well as continuous feedback on accuracy leading to necessary adjustments. This process helps expert skill development and refinement of the reliability and accuracy of expert knowledge, as well as highlighting errors in expert judgment. However, as SUDI cases are relatively rare, especially multiple intra-family SUDI, this often results in an expert who has not seen such a case, leading them to infer that the manner of death must be filicide, if all known causes have been eliminated. Consequently, the expert has difficulty developing expertise in the area due to lack of opportunity.

Psychological influences on medical decision-making and expertise development will be examined in Section II. It will be argued that medical decision-making about SUDI occurs in an environment where expertise is difficult to develop, as feedback on judgment accuracy is rarely available, opportunities are limited as the cases are rare, and contextual factors, such as psychosocial evidence, exert a biasing effect on judgments.

In Section III, Chapter 8 the legal and medical regulatory responses to the wrongful convictions and increasingly evident problems with medical opinion evidence will be discussed. It will be suggested that there has been a surprising lack of oversight

and regulation of the scientific basis, or, at the very least, clinical experience-based justification, for the opinions expressed in SUDI criminal trials. The developments affecting physicians investigating infant death have coincided with similar concerns with the scientific basis of many forensic sciences.[24] The problem of determining the reliability and accuracy of expert opinion evidence proffered in criminal, and civil, cases is a pervasive problem in both forensic science and medicine.

Lastly, in Section III, Chapter 9 the laws of evidence in common law countries and their operation in SUDI trials will be discussed. Expert opinion evidence is admitted on the basis of relevance and is an exception to the presumptive exclusion of opinion evidence. Expert opinion that satisfies the test for specialised knowledge, by study, training and experience, is admitted without assessment of the reliability of the opinion and its basis. It has been assumed that legal safeguards, such as cross-examination, rebuttal experts, judicial warnings and directions, and prosecutorial restraint, will constrain unfairly prejudicial or misleading evidence being presented to the jury. This has not been the case in SUDI trials in which medical opinion evidence of dubious value and unknown reliability, and conflicting opinion evidence has been left for the jury to resolve. The adversarial trial process has not revealed the significant disagreement in the medical community about cause of infant death investigation. Rather, expert evidence, admitted to assist the trier-of-fact, has likely subverted the search for truth and the provision of fairness in serious criminal proceedings.

[24] See discussion of forensic sciences, US National Research Council, *Strengthening Forensic Science in the United States: A Path Forward.* (National Academy Press, Washington DC, 2009).

Section I

Chapter 1: Overview of medical opinion evidence in sudden unexplained death in infancy

The two main types of medical specialists involved with sudden unexplained death in infancy (SUDI) investigations are forensic pathologists (at times, paediatric forensic pathologists) and paediatricians specialising in child protection. Paediatric forensic pathology refers to the post-mortem examination of deceased children in order to identify the medical, mechanical and manner of death. Paediatric forensic pathology[25] is 'an emerging medical subspecialty that spans the area between paediatric and forensic pathology'.[26] Pathological evidence assists in determining cause of SUDI and is relied on in criminal trials for child homicide. Expert evidence, such as pathology, is admitted to 'promote accurate decision-making in criminal cases'.[27] However, evidentiary accuracy is frequently limited by variability between experts' interpretation of death investigation results. Often reputable and credible experts proffer conflicting opinions based on the same data. There has been a tendency for pathologists to assert, with greater certainty than is warranted, that their opinion on the mechanical and medical cause of death is reliable and accurate. A leading Australian forensic pathologist, Stephen Cordner, aptly conveyed the dangers for pathologists in SUDI investigation:

> *There is no merit in forcing certainty where uncertainty exists. The very existence of the enigma of SIDS demonstrates how little we know about why some babies die. It is not for a pathologist*

[25] Hereafter referred to as pathology or pathologist.
[26] Krous, H.F, and Byard, R.W, 'Controversies in Paediatric Forensic Pathology' (2005) 1 *Forensic Science, Medicine, & Pathology* 9 -18 (10).
[27] Redmayne, M, *Expert evidence and criminal justice.* (Oxford University Press, 2004) 5.

to conclude that a number of infant or childhood deaths, with no significant pathological findings at all, are filicides on the basis of controversial circumstantial grounds.[28]

Pathological opinion that an infant or infants have died from inflicted or non-accidental mechanisms is typically the starting point for a prosecution case that a crime has been committed. Pathology opinion often emerges in concert with the Police with whom possible suspicions are discussed and further relevant information is sought and provided. Case information can therefore be available to the pathologist before an opinion is formed about the mechanical and medical cause of death. Complicating the death investigation process is the fact that identifying the mechanical and medical cause of death in infants is relatively more difficult than it is with adults.[29] Determining the cause of even one SUDI, let alone multiple deaths, is beset with uncertainties and often there are limited physical findings from autopsy.[30] Despite this uncertainty, medical experts have opined confidently that filicide is the explanation for recurrent SUDI.[31]

In recent decades, there has been increased social concern about child abuse and neglect, with paediatricians specialising in child protection acting as physicians and advocates for children.[32] Historically, child protection paediatricians[33] were general paediatricians and did not have specialised training in child abuse paediatrics, as such a speciality did not exist.[34] These paediatricians have acquired a significant role in

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[28] Ibid n 9, *Matthey*, 140. Dr Cordner holds the post of Professor of Forensic Medicine at Monash University, and Director of the Victorian Institute of Forensic Medicine.
[29] Brookman, F, and Nolan, J, 'The dark figure of infanticide in England and Wales' (2006) 21 *Journal of Interpersonal Violence* 869-889.
[30] Ibid n 21.
[31] See generally, Ibid n 8, *Clark*, *Cannings*, *Anthony*; Ibid n 9, *Phillips*.
[32] There is an inherent conflict of interest when physicians act as child abuse investigators and advocates for children. The conundrum for the child abuse physician is that his or her worst mistake would be to return a child to an abusive family. This might translate into a tendency to over-diagnose child abuse.
[33] Hereafter referred to as paediatricians.
[34] Cruickshanks, P, and Skellern, C, 'Role of the tertiary child protection paediatrician: Expert and advocate' (2007) 43 *Journal of Paediatrics and Child Health* 34–39.

investigating and managing suspected child abuse and death. This role developed from practice rather than specialised training and is not based on systematic research.[35] However, some paediatricians became increasingly concerned about the:

> *...standard of the science available to us in child protection and the separation of evidence from the mainstream assessment in medicine. Evidence-based medicine seemed to us to have passed child protection by.*[36]

One distinguished paediatrician, David Chadwick, asserted that scientific evidence for child abuse and homicide was 'well established' and child abuse evidence was 'robust', despite there being significant limitations to the scientific basis of medical aspects of child abuse.[37] The following discussion on SIDS/smothering and SBS confirms concerns about the reliability and accuracy of medical investigation of child abuse. The appellate cases considered in the thesis reveal the persuasive influence paediatricians have had on criminal trials for filicide and their role in wrongful convictions. The increasing importance of medical evidence in forensic settings has led to creation of fellowship programmes in forensic pathology and child abuse in USA, UK, Australia, and New Zealand.[38]

1.1 Medicine, evidence and evidence-based medicine

Medical opinion evidence is based on a centuries old tradition of medical knowledge that can be divided into two broad approaches: one emphasises empirical investigation

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[35] Sibert, J.R, Macguire, S.A, and Kemp, A.M, 'How good is the evidence available in child protection?' (2007) 92 *Archives of Disease in Childhood* 107–108.
[36] Ibid, 107.
[37] Chadwick D, L, 'The evidence base in child protection litigation' (2006) 333 *British Medical Journal* 160–1.
[38] Starling S, Sirotnak, A, and Jenny C, 'Child abuse and forensic pediatric medicine fellowship curriculum statement' (2000) 5 *Child Maltreatment* 58-62.

of cause of disease, while the other focuses on outcomes or observation of disease states, rather than causal mechanisms.[39] There is ongoing medical debate about the benefits of understanding basic micro-level mechanisms of disease (pathophysiology) compared to investigating outcomes for the average patient (as in randomised controlled trials). Another aspect of the debate is that clinical/subjective/qualitative evidence is held as inferior to large-scale controlled research designs. Essentially the tension is between qualitative and quantitative measurement and their respective reliability. Both forms of medical knowledge would seem to articulate well with criminal justice aspirations and values but for different reasons. Clinical judgment or case-specific medical opinion might explain how a particular infant died and whether it constitutes homicide, while population research may reveal vulnerabilities in the deceased that might account for medical cause of death.

The Hippocratic model of 'evidence'[40] preceded modern-day pathology and paediatric practice. This model derives knowledge from case studies and case series analyses. During Hippocrates' time, Greek medicine involved case treatment and accumulation of common sense knowledge, based on systematic observations. Hippocrates (and his followers) preferred careful investigation of naturally occurring events in clinical practice instead of clinical diagnosis based on pre-formed theories that could lead to bias. 'Physicians', the Hippocratic writings claim, 'compare the present signs with similar cases they have seen in the past, so that they can say how cures were

[39] Newton, W, 'Rationalism and Empiricism in Modern Medicine' (2001) 64 *Law and Contemporary Problems*: *Causation in Law and Science* 299-316.
[40] Ibid n 39.

affected then'.[41] Hippocratic principles valued knowledge derived from systematic case appraisal and cumulative experience in clinical practice.

Modern medicine, in contrast to the Hippocratic approach, has increasingly focussed on developing valid and reliable methods of detecting disease and ascertaining treatment outcome, which then informs clinical practice. This approach underlies evidence-based medicine (EBM), a term developed by the 'Evidence-Based Medicine Working Group' at McMaster University, which became prominent in the early 1990s,[42] influencing understanding of the relationship between clinical research and clinical practice. EBM has proven to be as influential as it is controversial. The EBM movement has shifted medicine towards a combination of clinical judgment and research-driven analysis for diagnosis and treatment of disorders or diseases.[43] Clinical epidemiology is a 'basic' science and EBM is the application of scientific techniques to clinical assessment of particular patients.[44] Despite the growth in laboratory and clinical research, and statistics, the resultant scientific knowledge was not uniformly applied to medical practice. Physicians trained mainly in basic sciences, struggled to not only stay abreast of the rapid growth in research but also lacked the requisite knowledge of statistics and critical thinking to interpret research findings.[45]

EBM offered a research hierarchy that replaced the traditional authority structures in medicine. EBM consisted of understanding certain 'rules of evidence' in

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[41] Lloyd, G.E.R, (Ed.) *Hippocratic writings.* (London, Penguin, 1978) 142.
[42] The Evidence-based Medicine Working Group, 'Evidence-based Medicine: A new approach to teaching the practice of medicine' (1992) 268 *The Journal of the American Medical Association* 2420-2425.
[43] Haynes, R.B, 'What Kind of Evidence is it that Evidence-Based Medicine Advocates want Health Care Providers and Consumers to Pay Attention to?' 2002 *BMC Health Services Research* 2-3 (3).
[44] Ibid n 42.
[45] Sackett, D.L, Rosenberg, W.M, Gray, J.A, Haynes, R.B, and Richardson, W.S, 'Evidence-Based Medicine: What it is and what it isn't' (1996) 312 *British Medical Journal* 71-72 (71).

addition to 'clinical experience and the development of clinical instincts'.[46] The rules of evidence consisted of a set of skills: precisely defining a patient problem and determining information required to resolve it; efficiently searching the literature and determining the relevance and validity of the studies retrieved; succinctly summarising and presenting the content, and strength and weaknesses of the papers; and finally extracting the 'clinical message' and applying it to the patient's problem.[47] The difficulty in achieving agreement between clinicians necessitated a structure that enabled comparative evaluations of evidence.[48] The 'first fundamental principle' of EBM is the hierarchy of research evidence, reproduced below.[49]

Quality of Evidence Ratings
Level I – Systematic review of all randomised controlled trials
I: Consistent evidence obtained from more than two independent, randomised, and controlled studies or from two independent, population-based epidemiologic studies. Studies included here are characterised by sufficient statistical power, rigorous methodologies, and inclusion of representative patient samples. Meta-analysis of smaller, well-characterised studies may support key findings.
Level II – At least one randomised controlled trial
II: Consistent evidence from two randomised controlled studies from independent centres, a single multicentre randomised controlled study, or a population-based epidemiologic study. Data included here have sufficient statistical power, rigorous methodologies, and the inclusion of representative patient samples.
Level III – Comparative studies
III-1: Consistent evidence obtained from two or more well-designed and controlled studies performed by a single research group.

[46] Ibid n 21, 2421.
[47] Ibid n 21, 2421.
[48] Daly, J, *Evidence-Based Medicine and the Search for a Science of Clinical Care.* (Los Angeles: University of California Press, 2005) 77.
[49] Montori, V.M, and Guyatt, G.H, 'Progress in Evidence Based Medicine' (2008) 300 *Journal of The American Medical Association* 1814-1816 (1815); Donohoe, M 'Evidence-based medicine and shaken baby syndrome part I: Literature review, 1966-1998' (2003) 24 *American Journal of Forensic & Medical Pathology* 239-242.

III-2: Consistent evidence obtained from more than one study but in which such studies have methodological constraints, such as limited statistical power, or the inclusion of patient samples that may be non-representative.
III-3: Evidence obtained from a single case study or a selected cohort study.
III-4: Conflicting evidence obtained from two or more well-designed and controlled studies.
Level IV – Case series or studies
IV: Consensus opinions of authorities according to clinical experience or descriptive reports.

This hierarchy of evidence, or more accurately, research design, places randomised controlled trials (RCTs) at the top and clinical opinion at the bottom. EBM accords relatively greater weight to scientific generalisations from averaging data across large groups than case-specific knowledge. EBM asserts that 'understanding certain rules of evidence is necessary to correctly interpret literature on causation, prognosis, diagnostic tests, and treatment strategy'.[50] Rules of evidence were to be designed by experts (e.g. clinical epidemiologists and statisticians) and then applied by physicians. The medical evidence hierarchy was therefore designed to reflect the methodological strength of various types of studies.

EBM assumes evidence higher in the hierarchy is less vulnerable to bias, and more likely to correctly attribute causal relationships to particular treatments and to accurately generalise beyond the study sample to the wider patient population. As EBM assumes that 'the randomised trial, and especially the systematic review of several randomised trials, is…more likely to inform us and…less likely to mislead us', this approach ought to promote clinical confidence.[51] The construction of the hierarchy ensures the best available evidence – systematic clinical observation, borrowed from the scientific methods used in epidemiology – is at the top.[52] Because it is thought to reduce

[50] Ibid n 21, 2421.
[51] Ibid n 45, 72.
[52] Scientific method involves taking a phenomenon or theory, developing a testable hypothesis about it and testing the hypothesis to see if it occurs as predicted. The associated measurements are expressed in

bias, randomisation, in which the researcher is blinded to category membership, is generally held to be the best method of allocating subjects to groups. Sackett and colleagues observe:

> *Evidence-based medicine is the conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients. The practice of evidence-based medicine means integrating individual clinical expertise with the best available external clinical evidence from systematic research.*[53]

EBM seeks therefore to address the reliability of medical evidence upon which clinical opinions are based. EBM emphasises the importance of population-level (epidemiological) studies in elucidating the causes of disease (or at least factors that are statistically associated with disease). This has relevance in SUDI, as a population-based, prospective study can provide base rates of a range of infant death and psychosocial indicators. In this domain, clinical case studies are insufficient.

It has been argued that evidence ranked highest in the hierarchy is not necessarily less biased than that below it.[54] Bias, in statistical terms, refers to 'a systematic distortion of an expected statistical result due to a factor not allowed for in its derivation; also, a tendency to produce such distortion'.[55] Statistical methodology has a narrow focus aimed at reducing confounding factors that are seen as possible sources of bias. Ross Upshur and colleagues developed a model of evidence that captures a wider

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mathematical or probabilistic terms. There is, however, no monolithic scientific method, as observed by the philosopher of science, Karl Popper. See Popper, K.R, *The Logic of Scientific Discovery.* 5th ed. (1992) 276-281. There is no gold standard for rules that determine the amount of evidence needed to support a theory, as there are many methods and procedures. Popper argued that the only necessary element of good science was 'falsifiability' or a willingness to be continually open to revision and critique.

[53] Ibid n 45, 71.

[54] Borgerson, K, 'Valuing evidence: bias and the evidence hierarchy of evidence-based medicine' (2009) 52 *Perspectives in biology and medicine* 218-233.

[55] The Oxford English Dictionary.

range of medical evidence, and their interrelationships, without imposing any comparative ranking.[56] The four distinct but related concepts of evidence they propose are:

- Qualitative/personal: evidence is narrative; socially and historically context-specific and individualised;
- Qualitative/general: evidence is social, historical and general;
- Quantitative/general: evidence is statistical, general, impersonal and quantitative; and
- Quantitative/personal: evidence is quantitative, yet individualised.[57]

EBM has focussed on quantitative/general evidence, often at the expense of other types of evidence. Exclusive focus on this type of evidence would exclude a vast body of information that could inform more systematic and controlled studies. This model acknowledges the value of all types of evidence, providing a general framework for understanding how each type of evidence can complement the others. This approach embraces a more nuanced, complicated description of the plurality of useful research methods than the hierarchical approach in EBM.

The value of different forms of medical evidence is the subject of ongoing debate within law, medicine, and philosophy. EBM asserts only certain kinds of scientific findings count as 'evidence'. Intuitive judgment or expertise, especially clinical judgment, is thought to have relatively less evidentiary weight, as it is less objective and more vulnerable to bias. Prominent legal scholar, Twining, argues that when a particular judgment about an event is required, the distinction is not between

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[56] Upshur, R.E.G, Van Den Kerkhof, E.G, and Goel, V, 'Meaning and measurement: an inclusive model of evidence in health care' (2001) 7 *Journal of Evaluation in Clinical Practice,* 2001 91-96.
[57] Ibid.

scientific and intuitive (subjective) judgement.[58] Instead, the distinction is between *different* kinds of generalisations (scientific, case-specific, common sense) and items of information, which serve evidentiary functions in developing an argument and are open to critical appraisal with regard to their evidentiary credentials, particularly relevance, credibility, and probative force.

Application of the highest EBM standards to SUDI is constrained by ethical and methodological issues. Diagnostic or clinical case studies cannot achieve EBM Level I status, although measures can be taken to reduce bias and improve accuracy and reliability of findings and conclusions. Standardised data collection, analysis (including case assignment and ascertainment, blind rating of signs), and cautious interpretation of findings can enhance the reliability and accuracy of clinical observations. The danger lies in obfuscating unjustified conclusions from clinical case study methodology and failing to improve investigative or research methodology. All forms of research in SUDI ought to be concerned with reducing bias and achieving reliable, rather than objective, results.[59] It is not the case that objectivity is achievable or that only objective evidence is reliable. The appearance of objectivity in current evidence-based medicine (or scientific) approaches is itself likely to be misleading. As Popper observed:

> *The old scientific ideal of episteme – of absolutely certain, demonstrable knowledge – has proved to be an idol. The demand for scientific objectivity makes it inevitable that every statement must remain tentative forever. It may indeed be corroborated, but every corroboration is relative to*

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[58] Twining, W, *Rethinking evidence: Exploratory essays.* (Cambridge University Press, Cambridge, 2006) 440.
[59] See Section I, Chapter 4, section 4.4 for further discussion of research methodology in SBS studies.

other statements that, again, are tentative. Only in our subjective experiences of conviction, in our subjective faith, can we be 'absolutely certain'. [60]

While the debate about what constitutes good evidence will continue, ultimately various forms of evidence are likely to be involved in understanding and explaining SUDI. As the following discussion of SIDS/smothering and SBS research will suggest, evidence relating to SUDI is primarily drawn from case studies or case series analyses. These studies lack independent corroboration of the mechanical cause of death, which can mean that it is difficult to ascertain the extent to which the expert's opinion represents the factual situation of the death. This is a significant error that is likely to have affected the reliability of medical knowledge of both types of SUDI. The heavy reliance on correlational measures that do not advance the question of causation – the main purpose of SUDI investigation – is an equally contentious issue. There is limited information on base rates (population prevalence) of signs considered to be indicative of filicide. In the context of evidence-based medical decision-making, it is appropriate that SUDI investigation and resultant medical opinion is subjected to similar expectations of demonstrable reliability and accuracy.[61]

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[60] Popper, K. R, *The logic of scientific discovery*. (London: Hutchinson, 1959) 280.

[61] Evidence reaching Level I or II (randomised trials) is unlikely to occur in SUDI research and physicians will inevitably be asked to give their opinions. Medical experts need to be transparent about the way in which their opinion was formed or state that they do not know why a death occurred. Equally, lawyers and judges need to develop skills to evaluate the reasoning behind the opinions.

Chapter 2: Sudden Infant Death Syndrome (SIDS)

This chapter examines current medical literature on SIDS[62] and concerns in the medical community – particularly in child protection – that SIDS includes undetected covert homicide from smothering. SIDS is difficult to define, post-mortem findings are limited or ambiguous, and there is considerable scope to misinterpret the mechanism leading to death, especially in cases of recurrent SIDS deaths. A critical problem is that it is rarely possible to independently corroborate whether death was actually caused by smothering, which affects the reliability and accuracy of the assumed mechanical cause of death.

SIDS is one of many categories of sudden unexplained death in infancy (SUDI). The conceptualisation of SUDI changed in 1969, following conferences on infant deaths held in Seattle, Washington.[63] Medical concern about unnecessary police involvement in SUDI and associated distress to bereaved parents led to a categorisation of SUDI cases as deaths from unknown, natural, or disease causes. The term, 'sudden infant death syndrome' (SIDS), an unexplained natural cause of death, was advanced.[64] The aim was to reduce parental trauma and fund research into the cause of the 'syndrome'. Emery observed:

> *Rarely has a syndrome been taken up so enthusiastically or based on such negative criteria…created an entity of unknown cause and was unpreventable, thus no blame could be attached to the parents. Similarly, no hospital, childcare authorities, or family or hospital*

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[62] 'Syndrome' often refers to a constellation of symptoms and outcomes but not the cause of these findings. The word syndrome is often used because the cause is not known.

[63] Bergman A.B, Beckwith J.B, and Ray C.G. (Eds), *Proceedings of the Second International Conference on Causes of Sudden Infant Death in Infants* (Seattle: University of Washington Press, 1970).

[64] Emery J.L, 'Infanticide, filicide, and cot death' (1985) 60 *Archives of Disease in Childhood* 505-507. When formal definitions are examined, while SIDS is thought to represent a natural cause of death, covert homicides are not excluded. Effectively, SIDS means a cause of death is undetermined or unascertained where the word 'cause' is both the medical cause of death and the manner of death (homicide, accident, natural).

physician could be blamed for any defect in care. It created a dramatic condition for which research money could be collected. The condition was very easy to diagnose, as in general the less found the more certain the diagnosis.[65]

SIDS has generated considerable debate and controversy with ongoing disagreement about the diagnosis. Generally, when an infant is found unexpectedly dead after falling asleep, with no medical or mechanical cause of death ascertained by history, autopsy, or other investigation, the death is assigned as SIDS.[66] A more comprehensive diagnosis applied currently is 'the sudden death of an infant under one year of age, which remains unexplained after a thorough case investigation, including performance of a complete autopsy, examination of the death scene, and review of the clinical history'.[67] The International Classification of Diseases (ICD-10) describes SIDS as natural death with 'ill-defined and unknown causes',[68] meaning that SIDS is always categorised as natural death.

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[65] Emery J.L, 'Child abuse, sudden infant death syndrome, and unexpected infant death' (1993a) 147 *Pediatric Legal Medicine* 1097-1100, 1097.

[66] Beckwith, J.B, 'Discussion of terminology and definition of the sudden infant death syndrome' In: Bergman, J.B, and Ray, C.G. (Eds) *Proceedings of the second international conference on causes of sudden death in infants* (Seattle: University of Washington Press, 1970) 14–22.

[67] Willinger, M, James, L.S, and Catz, C, 'Defining the sudden infant death syndrome (SIDS): Deliberations of an expert panel convened by the National Institute of Child Health and Human Development' (1991) 11 *Pediatric Pathology* 677–84.

[68] *World Health Organization, International Classification of Diseases and Related Health Problems, Tenth Revision* (Geneva, Switzerland: World Health Organization, 1992); Notably, many natural deaths could also be covert homicides, so diagnosing a natural disease does not exclude the possibility of homicide. Most causes of death are opinions based on combinations of medical history, autopsy findings, if one is undertaken, and the circumstances of the death. Cordner, personal communication, 2013.

Before the mid-1940s, sudden unexpected infant death was attributed to mechanical suffocation.[69] In 1944, Abramson [70] suggested that risk factors for accidental mechanical suffocation of infants during sleep could be sleeping in a prone, facedown position, and bed sharing with the mother and subsequent overlaying. Since the inception of the term SIDS in 1969,[71] SIDS mortality rates dramatically increased and then declined in many countries, the decline being attributed to 'Back to sleep' public education campaigns which promoted laying babies on their back to sleep.[72]

In the 43 years since Beckwith's 1969 formulation of SIDS, there have been over 100 theories attempting to explain the phenomena.[73] Emery proposed a 'three inter-related causal spheres of influence model' in which any two of these three factors could cause SIDS: (1) subclinical tissue damage, (2) deficiency in postnatal development of reflexes and responses, and (3) environmental factors.[74] Filiano and Kinney also proposed a 'triple risk model' that required three risk factors, similar to Emery's, to act simultaneously and described them as: (1) vulnerable infant; (2) critical development

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[69] Byard, R.W, and Krous, H.F, 'Sudden infant death syndrome: overview and update' (2003) 6 *Pediatrics & Developmental Pathology* 112–1127.

[70] Abramson, H, 'Accidental mechanical suffocation in infants' (1944) 25 *Journal of Pediatrics* 404–13.

[71] Ibid n 66, 18.

[72] See Overpeck, M.D, Brenner, R.A, Cosgrove, C, Trumble, A.C, Kochanek, K, and MacDorman, M, 'National underascertainment of sudden unexpected infant deaths associated with deaths of unknown cause' (2002) 109 *Pediatrics* 274–83; Malloy, M.H, and MacDorman, M, 'Changes in the classification of sudden unexpected infant deaths: United States, 1992–2001' (2005) 115 *Pediatrics* 1247–53; Pollack, H.A, 'Changes in the timing of SIDS deaths in 1989 and 1999: indirect evidence of low homicide prevalence among reported cases' (2006) 20 *Paediatric & Perinatal Epidemiology* 2–13; American Academy of Pediatrics Task Force on Sudden Infant Death Syndrome, 'The changing concept of sudden infant death syndrome: diagnostic coding shifts, controversies regarding the sleep environment, and new variables to consider in reducing risk' (2005) 116 *Pediatrics* 1245–55.

[73] Mage, D.T, and Donner, M, 'A Unifying Theory for SIDS' (2009) 2009 *International Journal of Pediatrics* 1-10.

[74] Emery, J.L, 'A way of looking at the causes of crib death' In Tildon, J.T, Roeder, L.M, and Steinschneider, A, (Eds) *Proceedings of the International Research Conference on the Sudden Infant Death Syndrome*, (New York, USA, Academic Press, 1983) 123–132.

period; and (3) environmental stressors.[75] Neither theory has adequately explained the SIDS phenomenon. Similarly, the hypothesis of a 'unitary' cause and the continued use of the 'syndrome' concept has been challenged.[76] Some reports stated that the characteristics and risk factors for SIDS, accidental suffocation and, in some cases, intentional suffocation were similar.[77] The idea of shared risks and features may have been due to the (ongoing) difficulties in distinguishing between SIDS, and accidental and intentional suffocation. That is, given the lack of specificity or clarity as to what signs constitute SIDS, it is likely that studies identifying causes of death may have inadvertently included a range of disorders or mechanisms of death. Given the lack of consensus about what constitutes SIDS, it is not surprising that research attempting to explain SIDS has been inconclusive. Byard has summarised research in SIDS as follows:

> *SIDS appears destined to continue to be a difficult, contentious and emotive term that can, unfortunately, be used very easily as a 'diagnostic dustbin' to disguise incomplete investigations and inaccurate conclusions ... It is a rather disappointing fact that debate continues about the most appropriate definition of SIDS ... Our understanding of the pathogenesis of SIDS is still*

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[75] Filiano, J.J, and Kinney, H.C, 'A perspective on neuropathologic findings in victims of the sudden infant death syndrome: the triple-risk model' (1994) 65 *Biology of the Neonate* 194–197.

[76] Emery, J.L, 'Is sudden infant death syndrome a diagnosis? Or is it just a diagnostic dustbin?' (1989) 299 *British Medical Journal* 1240; Gilbert-Barness, E, 'Is sudden infant death syndrome a cause of death?' (1993) 147 *American Journal of Diseases in Childhood* 25-26.

[77] Emery, J.L, and Thornton, J.A, 'Effects of obstruction to respiration in infants, with particular reference to mattresses, pillows, and their coverings' (1968) 3 *British Medical Journal* 209–13; Kemp, J.S, and Thach, B.T, 'Sudden death in infants sleeping on polystyrene-filled cushions' (1991) 324 *New England Journal of Medicine* 1858–64; Chiodini, B.A, and Thach, B.T, 'Impaired ventilation in infants sleeping facedown: potential significance for sudden infant death syndrome' (1993) 123 *Journal of Pediatrics* 686–92; Ponsonby, A.L, Dwyer, T, Gibbons, L.E, Cochrane, J.A, and Wang, Y.G, 'Factors potentiating the risk of sudden infant death syndrome associated with the prone position' (1993) 329 New England Journal of Medicine 377–82; Emery, J.L, 'The dangers of soft bedding for infants' (1993b) 69 *Archives of Diseases in Childhood* 711; Byard, R.W, Beal, S, and Bourne, A.J, 'Potentially dangerous sleeping environments and accidental asphyxia in infancy and early childhood' (1994) 71 *Archives of Diseases in Childhood* 497–500.

incomplete, and this is reflected in the vast number of often contradictory papers that have been published in recent years.[78]

Despite advances in preventing infant mortality, determining the cause of SIDS has proven to be elusive. This is at least partly to do with the difficulty in diagnosing SIDS. Byard and Krous[79] have observed that many subtle natural diseases in infancy can result in unexpected death, and infants may be seriously ill with few signs and signs. Moreover, the autopsy findings in infants after accidental or inflicted asphyxia are often minimal 'as SIDS is diagnosed through a process of exclusion, the term SIDS should not be used if there is possible accidental asphyxia, inflicted injuries, or significant organic diseases'.[80] Therefore, even when all of the conditions of the SIDS definition are met, it is difficult to exclude unnatural deaths such as accidental and intentional death. This means that SIDS is unlikely to be a specific disease with a single cause, but is more likely attributable to heterogeneous causes.[81] Nonetheless, confusion about the definition of SIDS remains, which, in turn, affects studies attempting to unscramble the complex set of causes and signs characteristic of SIDS. Suffice it to say that the authors of a recent publication commented, 'SIDS is therefore the label used when we don't know why the baby died'.[82]

2.1 Differentiating SIDS from smothering

When it is suspected that a case of SUDI is homicide, the issue is whether medicine can reliably or accurately identify whether the deceased infant or infants died of natural,

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[78] Byard, R.W, *Sudden Death in Infancy, Childhood and Adolescence* (2nd ed, 2004).
[79] Ibid n 21.
[80] Ibid n 21.
[81] Ibid n 21.
[82] Blair, P.S, and Fleming, P.J, 'Recurrence risk of sudden infant death syndrome' (2008) 93(4) *Archives of Diseases in Childhood* 269-270.

accidental or inflicted causes. The empirical uncertainty of what actually constitutes SIDS makes it difficult to separate death caused by inflicted means, such as smothering, from other natural or unnatural causes. Indeed, differentiating SIDS from inflicted suffocation continues to challenge paediatric forensic pathologists, as there are no physical findings that differentiate reliably between the two conditions.[83] Consequently, any SIDS death could be a case of smothering (accidental or homicidal) when considering the autopsy findings in isolation.

SIDS researchers, often pathologists, and paediatricians dealing with child abuse, led medical research into how apparently well infant(s) come to die suddenly. John Emery, a respected English pathologist investigating SIDS and its correlates, was the first to suggest that deaths attributed to SIDS might actually include cases of fatal maltreatment.[84] He suggested that 1 in 10 unexpected infant deaths might not have been natural and proposed that 'gentle battering', a physical act that leaves no mark, such as smothering an infant with a pillow or a hand over the infant's mouth, should be considered as a potential mechanical cause of death.[85] Later, in 1985, Emery suggested that 2 – 10%[86] and, in 1993, 10 - 20%,[87] of deaths classified as natural deaths might be instances of covert homicide.

The empirical evidence supporting Emery's estimates of homicide is critical to understanding his suggestion that some unexplained infant deaths are homicide. At the outset it is worth noting that, being primarily a researcher into SIDS, Emery's aim was

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[83] Byard, R.W, and Jensen, L.L, 'Fatal asphyxial episodes in the very young: classification and diagnostic issues' (2007) 3(3) *Forensic Science, Medicine, and Pathology* 177-181.
[84] Ibid n 58; Taylor, E.M, and Emery, J.L, 'Two-year study of the causes of postperinatal deaths classified in terms of preventability' (1982) 57 *Archives of Diseases in Childhood* 668-673.
[85] Emery, J.L, 'Aviemore meeting and the gently battered child' (1983) 58 *Archives of Diseases in Childhood* 75-80.
[86] Ibid n 64.
[87] Ibid n 65.

to promote better death investigation and support of bereaved parents, especially mothers. Emery's estimates of homicide were based on a thorough death investigation intended to indicate if the death was an identifiable case of homicide. However, Emery did not clarify the criteria needed to detect or confirm covert homicide. Emery's studies, dating from the early 1980s to 2000, when he died, were a harbinger of the work conducted by Carpenter's prospective study in recent years.[88] In his 1990 paper, co-authored with Taylor, Emery described their confidential inquiry into deaths in infants aged 1 week to 5 years in Sheffield, which excluded deaths in which the parents or guardian was charged.[89] All infants classified as 'unexpected death in infancy' aged 8 days to 1 year were included in the study. The categories of preventable death in the study were: poor prognosis, treatable disease, minor disease, no disease, probable accident and probable filicide. The study methodology involved conducting confidential case conferences with professionals until consensus was reached about the (presumably) mechanical cause of death. The authors observed that the fact of homicide (and incidentally, accidental death) became apparent during these inquiries. Despite several publications relating to his homicide estimates, the clearest description of how Emery and his colleagues determined mechanical cause of death was presented in this paper. Of the total sample of 115 deaths, eight cases were thought to be homicide. These cases were classified as homicide because they were 'thought at the case conference probably to have been the result of an action by one of the parents'.[90] The authors commented that this category was assigned only when all members of the conference agreed the death

[88] Discussed later in the chapter.
[89] Taylor, E.M, and Emery, J.L, 'Categories of Preventable unexpected infant Deaths' (1990) 65(5) *Archives of Diseases in Childhood* 535-9.
[90] Ibid, 536.

was homicide. This comment suggests that agreement via case conference was considered to be proof of homicide. There is no evidence of independent verification of the suspected homicide deaths and the reliability or accuracy of the categorisation cannot be determined with the information provided by Emery and his colleagues. Emery and Taylor comment that in infant death cases there is no objective standard of proof or 'sufficiency of cause',[91] therefore:

> *In this study we have tried to eliminate research bias by making the classification of each death during the case discussion.*[92]

These observations are interesting as, arguably, there *is* objective proof that an infant death is a case of homicide. However, medicine and science has not yet found ways of detecting the necessary proof (probably witnessed homicide). This reflects the current limitations of medical and scientific inquiry, as opposed to proving that there is no objective standard of proof of mechanical cause of death. Group consensus, which is the way in which Emery and his colleagues confirmed suspected cases of homicide, is not a reliable substitute for efforts to find more objective, or at least, independent forms of proof.

Emery and colleagues' estimates had a wide impact. Cunliffe, a legal scholar, observed that subsequent authors, in legal, medical and criminological communities (who have quoted Emery and colleagues' estimates, which were based on their *suspicions*) have presented their work as if the cases were *proven* cases of covert homicide;[93] that is, they 'do not convey the full import of their original context, in which

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[91] Ibid, 539.
[92] Ibid, 539.
[93] See, e.g, Wilczynski, A, *Child Homicide* (London, Greenwich Medical Media, 1997).

Emery's figures are almost invariably treated as strong proof of an associated number of unprosecuted and unidentified homicides'.[94] These communities have uncritically accepted and asserted that there is an undetected but very real likelihood that in any population or group of unexplained infant death, some 2 – 20% are homicide.[95] Proponents of the notion that smothering has been misdiagnosed as SIDS have relied on Emery's estimates of the amount of cases likely to be homicide (that is, 2 – 10%[96] and that 10 – 20%[97] of infant deaths) to support their view that the SIDS figures obscured covert homicide.[98] For instance, Levene and Bacon applied the 10% covert homicide rule to their estimate of the number of homicides hidden within the SUDI group as a whole.[99] They estimated that if there were 1000 SUDIs per year in England and Wales, 100 to 200 would be covert homicide. Similarly, Wilczynski[100] relied on Emery's higher 1993 estimate to calculate her estimate of child homicide. It is also possible that Emery and his colleagues, despite their caution, have inadvertently contributed to the misuse of their findings by failing to emphasise that their cases of suspected homicide were based on psychosocial and autopsy evaluations which are indirect proof of homicide and should not be taken as confirmed homicides as the reliability and accuracy of these assessments are unknown.

In an effort to unscramble the complex messages emanating from research into sudden unexplained infant death (SUDI), Cunliffe conducted an extensive review of the

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[94] Ibid n 15, 50.
[95] Ibid 15, 49 for elaborated discussion of this point.
[96] Ibid n 64.
[97] Ibid n 65.
[98] For example, Meadow, R, 'Unnatural sudden infant death' (1999) 80 *Archives of Diseases in Childhood* 7 – 14.
[99] Levene, S, and Bacon, C.J, 'Sudden Unexpected Death and Covert Homicide in Infancy' (2004) 89 *Archives of Diseases in Childhood* 443.
[100] Ibid n 93.

research evidence on death investigation in apparent suffocation- or smothering-related SUDI and recurrent intra-family SUDI. The analysis was based on the following factors: the manner in which cause of death was determined, the origin of often-quoted statistics (such as, 2 – 10% of SUDI represent covert homicide), and the reliability of indicators of inflicted death. Cunliffe found that the operating assumption seemed to be that all deaths believed by pathologists to be inflicted should result in criminal conviction. However, Cunliffe has identified two crucial conflations in the criminological, legal and medical literature that have contributed to the problem of citing Emery's suggestions of homicide as fact. Firstly, suspicions about the mechanical cause of death and evidence that meets a criminal standard of proof have been merged into one entity. Secondly, when an instance of infant homicide has not been detected by current medical methods, it has been assumed that the death was *not* homicide. However, *lack* of medical evidence of homicide does not constitute proof that death was *not* homicide. In a sense, the two instances of conflation seem to reflect a faith that medical opinion about the manner and mechanical cause of death, even if it is only a suspicion, is factual and reliable and that a conviction confirms that a crime was committed. This reasoning is circular and overlooks the fact that neither medical opinion nor a conviction is proof of homicide. As it is unknown whether medical investigative techniques can reliably detect and differentiate homicide from other causes of death, medical evidence does not advance the question of whether the death was or was not homicide. Medical experts have substantiated their suspicions by reference to convictions as proof of homicide, while the law has accepted medical opinion evidence, often no more than a suspicion, as meeting the criminal standard of proof. That is, medical opinion evidence that a death is homicide can in fact be nothing more than a suspicion, yet the law accepts this opinion

as meeting the criminal standard of proof. Indeed, if the Court delved further and better into the opinion, it would discover the nature of the opinion.

Cunliffe has proposed a way of categorising the studies she reviewed to take into account homicides that medicine has not detected and homicides in which the criminal standard of proof has not been met.[101] The taxonomy distinguishes between types of evidence that may lead a child death investigation team to a conclusion that a death is inflicted, in order that conclusions based on different types of evidence can be subjected to different analyses. Category one is the strongest form of evidence as it is based on physical evidence (autopsy) of homicide and is probable deliberate smothering or inflicted death. Category two refers to cases where there is evidence of deliberate smothering based on death investigation or psychosocial factors. Category three refers to deliberately inflicted deaths that were not distinguishable at autopsy or death investigation, or death investigation was not conducted.[102] Cunliffe argues that it is not accurate to classify probable deaths as category three or covert homicide. Rather, they are suspicious deaths that require investigation before deciding whether they should be assigned to category one or two. Applying this taxonomy to the Emery and colleagues' dataset, Cunliffe argues their cases are either category one or two, as they have been investigated, rather than being undetected or covert homicide (category three). Cunliffe comments that these deaths 'do not advance the question of whether some mothers kill

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[101] Ibid n 15, 42 Category one deaths, which are identified on autopsy alone as probable deliberately inflicted deaths (for example, through anatomical, histological or toxicological findings); Category two deaths, which forensic pathologists, coroners or police identify as probable deliberate smothering deaths, based on the death investigation or 'psychosocial' information about the infant's family, perhaps in combination with autopsy findings; Category three deaths, which are deliberately inflicted but not identified as such through autopsy, death investigation, or otherwise, either because a thorough investigation is not performed or because the death is indistinguishable from a death by natural causes.
[102] Ibid n 15, 42.

their infants without detection, after a thorough autopsy, death scene investigation and case conference'.[103] She concludes:

> *It is not possible to extrapolate from the work of Emery and colleagues that any proportion of unexpected infant deaths that are thoroughly investigated at the time of death are wrongly attributed to natural causes such as SIDS.*[104]

This analysis clearly revokes Emery's work as providing any valid basis for the notion that infant homicides are being missed and are not being properly prosecuted. That is, parents are getting away with murder. If, after a thorough investigation, there is insufficient proof to move the suspicion that a case is homicide to the level of confirmation, then the case is *not* an undetected homicide. The misuse of Emery and colleagues' estimates has overlooked this critical point and fostered an alarmist belief that covert homicides comprise a percentage of unexplained infant deaths.

Another aspect of the estimates put forward by Emery and his colleagues is that they are primarily based on confidential case conferences in which psychosocial factors, along with medical evidence, have been the primary basis for the decision that the case should be classified as a homicide. The next section briefly discusses psychosocial aspects of death investigations.

2.2 Psychosocial factors and SUDI investigation

Taylor and Emery have documented several adverse psychosocial characteristics of their overall sample. These are: paternal and maternal background and upbringing; health; intelligence and competence (an example being falling asleep on the couch with the baby

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[103] Ibid n 15, 51.
[104] Ibid n 15, 51.

while intoxicated); financial stress; maternal bonding; crisis at time of birth; housing; family support; and failure to communicate.[105] Taylor and Emery do not describe the statistic used to analyse their data, other than means and range of scores for the sample. It seems, however, that the authors have correlated the sample characteristics measured with the six categories of death which their sample was divided into and conducted a chi-square analysis looking at whether the pattern of characteristics between the six study groups are (statistically) significant or different from each other. As the authors point out, the (presumably) correlation data indicate that the most adverse circumstances were present in the 'treatable disease' group. This is an interesting finding in light of the weight given to psychosocial factors such as those described in this study [106] in criminal trials for infant murder. Yet this dataset does not demonstrate a correlation, especially a statistically significant correlation which would mean the association is greater than chance, between the homicide cases and the adverse circumstances. This finding raises the question whether psychosocial factors are always relevant in assessment of possible homicide if the factors on which the assessment is made are ubiquitous or do not differentiate between homicide and other causes of death. There is a real risk that a narrative of guilt develops in the minds of investigators when psychosocial and medical evidence is combined leading to unreliable and inaccurate inferences being made about the mechanical cause of death.

There are methodological problems with Emery and Taylor's research. The sample size contained only eight suspected inflicted deaths. There were many measures

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[105] I will return to these characteristics or arguably psychosocial factors during the chapter. This type of evidence is often the 'cogent' other evidence referred to in *Kai-Whitewind*, which was distinguished from *Cannings* where the court held that disagreement between reputable experts without other cogent evidence should not proceed to trial.

[106] Ibid n 8 (*Clark*, *Cannings*, *Anthony*, *Kai-Whitewind*); n 9 (*Folbigg*, *Matthey*).

of the various psychosocial factors, which can increase the likelihood of error in measurement. Typically in empirical or rigorous research methodologies, it is accepted that the greater the number of variables measured in a study, the higher the sample size needs to be to prove that an effect is significant and beyond chance. This protective mechanism to avoid erroneous conclusions has not been applied to SIDS/smothering research. It is quite possible that apparent abnormalities in measured variables were an artefact of the research design.

The reliance on psychosocial assessments to confirm that an infant death is a case of homicide is problematic for several reasons as these assessments rest on a variety of psychosocial factors, which are taken to be indirect proof that death was from deliberate smothering.[107] Indeed, Emery and his colleagues' estimates of homicide consistently depend on assessed psychosocial adversity and case conferences that continue until consensus is reached. The authors note that in cases where homicide was confirmed, there were grave concerns held by the professionals who assessed these deaths. Taylor and Emery commented:

> *These cases are distinguished from the unexplained unexpected deaths only by a joint social and pathological study.*[108]

This approach is likely to force certainty in a context where the medical evidence is equivocal and the discriminatory power of the psychosocial characteristics is unknown. Emery's estimates of homicide of his own sample (ranging from 4.6 in 1982 to 7% of

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[107] The issue of the predictive value of psychosocial factors is not pursued in this thesis, apart from a brief discussion in Chapter 6 of this section. However, it is an important issue in understanding infant deaths attributed to homicide.
[108] Ibid n 84, 673.

the sample in 1990) are based on consensus driven confidential inquiries focussing on medical and psychosocial factors.

The classification of the psychosocial factors are not standardised, therefore rendering the data unable to be compared to other studies, and the categories are broad and non-specific. Emery and Taylor note that 'only serious factors were recorded',[109] an approach that risks selection bias. For instance, if the mother had been taken into care by welfare authorities or was abused as a child, the mother's background was included in the study. While involvement with child protection services is not a generalised population phenomenon, this study shows that the non-homicide group actually had *more* exposure to adversity than the homicide group, which seems to nullify their hypothesis that psychosocial factors can differentiate homicide from other causes of death. Furthermore, measuring only factors thought to be serious by the researchers skews the perspective of the sample towards dysfunction, while the omission of positive characteristics is likely to overlook potentially meaningful information about the sample. Perhaps the most troubling aspect of the study is the lack of clarity as to *how* the homicides were determined to be so (apart from a consensus seeking conference) and the lack of independent corroboration that these cases have been accurately classified.

The reliance on psychosocial factors that are often ubiquitous in death investigation is evident in the wider medical literature on SUDI. For instance, Beal, a paediatric pathologist, who examined recurrent infant death in South Australia between 1970 and 2001, found that 20 families experienced recurrent infant death.[110] Of these

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[109] Ibid n 84, 536.
[110] Beal, S.M, 'Recurrence of Sudden Unexpected Infant Death in a Family' In Byard, R.W, and Krous, H, (Eds), *Sudden Infant Death Syndrome: Problems, Progress & Possibilities* (New York: Oxford University Press, 2001) 281.

families, two were proven to be homicides and four were suspected homicides. Beal proposed that it is possible to detect covert homicide based on 'clues to filicide', including abuse of other children and infants; recurrent ALTEs (acute life threatening event – brief cessation of breathing); Munchausen Syndrome in the mother or perpetrator; reluctance to be involved with or occasionally obsessive involvement with the SIDS association; family suspicion; and conflicting statements about the circumstances around the death.[111] Limitations in Beal's research are two-fold: there are concerns about generalisability and significance of conclusions from such a small sample size with numerous measures. Beal's conclusions were based on clinical experience, that is, on her own experience in diagnosing mechanical causes of death. Whilst there is no doubt that clinical experience is the source of many insightful observations, the absence of corroborative support of independent research conducted rigorously or independent verification of the mechanical cause of death means the accuracy of Beal's conclusions is unknown.

Similarly, Meadow has asserted that 'between 2 and 10% of babies currently labelled as dying from SIDS have probably been smothered by their mothers.'[112] He does not cite any empirical support for the assertion but it is likely that the estimate is drawn from Emery's papers. Meadow asserted that 'warning features that the sudden infant death syndrome may have been caused by mother smothering her child are: previous episodes of unexplained apnoea, seizures or 'near miss cot death'; an infant aged more than 6 months; previous unexplained disorders affecting that child; and other unexplained deaths of children in the same family'.[113] These supposed characteristics of

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[111] Meadow, R, 'ABC of child abuse. Suffocation' (1989) 298 *British Medical Journal* 1572–3.
[112] Ibid, 1572.
[113] Ibid, 1572.

covert smothering have no independent validity as markers of homicide. Furthermore, the previous unexplained disorders affecting the child or other unexplained deaths in the family could simply be manifestations of the same unexplained disorder that caused the death of the child, and not necessarily homicide. In the absence of reliable supporting evidence (whether clinical or empirical research), the assertions made by Beal and Meadow imply that these psychosocial features are *indicative* of abuse and homicide. There is a very real danger that these characteristics, viewed from the perspective of covert, undetected infant homicides, will yield false positives or incorrect classification of the death as homicide.

In another publication, Meadow supported his assertion that covert homicide has been misdiagnosed as SIDS based on convictions (in trials in which he gave evidence), a confession supported by circumstantial evidence of guilt, and reliable observation of smothering behaviour.[114] The last form of validation is likely most accurate but convictions in trials in which Meadow himself gave evidence are questionable in terms of accuracy.

When the assertions about incriminating psychosocial evidence are coupled with the belief that covert infant homicide is going undetected, it is likely that unexplained deaths will be misclassified as homicide, instead of the manner of death being classified as unknown. If one *assumes* that unexplained death, after excluding other causes, is evidence of homicide, then it is inevitable that homicide will be seen as the manner of death. This approach does not countenance the possibility that there may be many other causes, currently unknown, that would explain the death. Rather some specialists, such as Beal and Meadow, assert that there are reliable ways of detecting

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[114] Ibid n 23, 351.

covert homicide based on certain psychosocial and medical risk factors that distinguish deliberate smothering from accidental, natural or disease processes. This stance is not supported by empirical evidence. Most importantly, the position that there is 2 - 10% undetected covert homicide is not supported by Emery's research, from which these figures are drawn, and assuming psychosocial factors are indicators of homicide is unsupported by the available research. This approach does not provide any independent corroboration of homicide and the accuracy of the assigned manner of death is uncertain.

2.3 Studies of SIDS recurrence

Like covert homicide, the estimation of SIDS recurrence has been a controversial area of debate in the medical community. There have been two main empirical research and support programmes examining SIDS recurrence: the Confidential Enquiry into Stillbirths and Deaths in Infancy (CESDI) and the Care of Next Infant (CONI). The CESDI sudden unexpected death in infancy (SUDI) study was a population-based, case-control study of all births in several regions of the United Kingdom between 1993 and 1996.[115] The study examined all SUDIs with a standardised protocol, including medical and psychosocial investigation, shortly after death. The Care of Next Infant (CONI) was a programme supporting families in which one SIDS death had already taken place.[116] The CONI study followed-up all subsequent siblings of the index deceased infant. CONI conducted an 11-year follow-up of families in its programme with retrospective, unstructured psychosocial interviews and review of medical evidence (autopsy including histology) by a panel and confidential case conferences.

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[115] Fleming, P, Blair, P, Bacon, C, and Berry, P.J, *Sudden unexpected deaths in infancy: the CESDI SUDI studies 1993–1996* (London: Stationery Office, 2000).
[116] Carpenter, R.G, Waite, A, Coombs, R.C, Daman-Willems, C, McKenzie, A, Huber, J, and Emery, J.L, 'Repeat sudden unexpected and unexplained infant deaths: natural or unnatural?' (2005) 365 *The Lancet* 29-35.

The CESDI study found that there are significant differences in SIDS recurrence risk between subgroups of the SIDS population.[117] The three main risk factors identified are multi-parous young mother under 25 years of age, no waged income, and the presence of a smoker in the household.[118] In fact, the CESDI report demonstrated a 40-fold increase in risk in high-risk families relative to low-risk families.[119] Therefore, any calculation of recurrence rates must incorporate stratification for degree of risk, without which the high likelihood of repeat SIDS in high-risk families gives a false impression of an increased risk for the population as a whole. The contribution of the CESDI study is the detailed identification of possible risk factors for SIDS recurrence and the importance of using controls matched for degree of risk for SIDS. While these risks are correlations and therefore do not reveal causal processes, they are a guide to possible factors leading some families to being more vulnerable to recurrence than others. More importantly for determining whether recurrent SUDI cases constitute homicide, recurrence of SIDS is *not* impossible, as suggested by some medical experts in court proceedings.[120]

The CESDI study also highlighted the need for comprehensive investigations of *all* SUDI. Diagnosis of SIDS requires a thorough autopsy. However, even with autopsy, it is difficult to exclude familial diseases that can cause SUDI, as there are many that have yet to be identified. For example, the best-known disorder, medium-chain acyl-coenzyme A dehydrogenase deficiency (MCAD), was only identified in 1984.[121] Many

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[117] Ibid n 115.
[118] Ibid n 115, 5 Results of Confidential Inquiries 142.
[119] Ibid n 115.
[120] See, generally, expert evidence on the unlikelihood of SIDS recurrence in Ibid n 8 (*Clark, Cannings, Anthony*), n 9 (*Folbigg, Matthey*).
[121] Howat, A.J, Bennett, M.J, Shaw, L, et al, 'Medium-chain acylcoenzyme A deficiency presenting as sudden infant death syndrome' (1984) 288 *British Medical Journal* 397.

other familial disorders are being identified; each is uncommon and most characterised by recessive inheritance, or in genetic terms, 'hidden' genetic attributes. These diagnoses may account for some proportion of recurrent SUDI. The impracticality and expense of conducting tests of *all* known disorders means that all tests may not be conducted in all cases. Without confirmation of such rare causes of death, these deaths may continue to be misdiagnosed as SIDS and lead to an overestimation of recurrence rates. This point is also relevant when deciding whether a case constitutes homicide. Accuracy in death assignment cannot be overestimated.

One of the central issues in understanding recurrence is identifying the circumstances in which SIDS recurrence occurs, given that families in which one SIDS death has occurred are different to families in the general population, as suggested by the CESDI study. Hill[122] has pointed out that it is a mistake to square the probability of a single SIDS death to obtain the probability of two SIDS deaths in a family, as the events are not independent given the shared genetic and environmental factors in each death. Hill published his statistical analysis in response to evidence proffered by Meadow in *Clark*, in which he squared the likelihood of one death, based on CONI data, to arrive at the estimate that the chances of SIDS recurrence is 1 in 73 million.[123] Recently Campbell and colleagues[124] used the CESDI data to calculate the number of second SIDS cases predicted by the three risk factors identified in the CESDI index families. The aim was to account for the fact that families in which a SIDS death had already occurred were not comparable to the general population. That is, this group is

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[122] Hill, R, 'Multiple sudden infant deaths: coincidence or beyond coincidence?' (2004) 18 *Paediatric & Perinatal Epidemiology* 320–26.
[123] See Ibid n 8 *Clark.*
[124] Campbell, M.J, Hall, D, Stephenson, T, Bacon, C, and Madan, J, 'Recurrence rates for sudden infant death syndrome (SIDS): The importance of risk stratification' (2008) 93 *Archives of Diseases in Childhood* 936-939.

not a random cross-section of the population. Rather, the group has a higher proportion of high-risk families meaning that the predicted risk of a second death is also higher in this group than in the overall population. In order to reflect the wider UK population than the CESDI sample, the authors devised hypothetical prevalence rates of the risk factors based on the CESDI data. The model predicted that recurrence risk in a population in which SIDS has already occurred once and which has a high prevalence of the risk factors to be 1:456 (three times the population risk) and 1:1046 for a low-risk prevalence group, which is still higher than the population risk.[125] This suggests that, once there has been a SIDS death, regardless of the level of risk factors, the likelihood of recurrence is higher than in the general population but the highest risk is in families that have the three CESDI risk factors.

Although confidential inquiries conducted by Emery and his colleagues concluded that approximately two-fifths of repeat SUDI are likely to be the result of covert homicide,[126] Carpenter and his colleagues (see below), including Emery himself, thought the proportion was smaller in their sample.[127] Emery and colleagues also estimated that the likelihood of repeat SIDS in a family that had had one SIDS death was three times greater than the population.[128] Notably, the confidential enquiry estimates are based on the methodology Emery and colleagues used for their single covert homicide studies, that is, confidential inquiries based on medical and psychosocial review aimed at consensus. This methodology is problematic because the way in which decisions were made in the confidential inquiries is unclear and standardised decision-

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[125] Ibid, 938.
[126] Emery, J.L, 'Families in which two or more cot deaths have occurred' (1986) 1 *Lancet* 313–15; Wolkind, S, Taylor, E.M, Waite, A.J, Dalton, M, and Emery, J.L, 'Recurrence of unexpected infant death' (1993) 82 *Acta Paediatrica* 873–6.
[127] Emery was also part of Carpenter's group; Ibid n 116.
[128] Ibid n 126, Emery; Ibid n 126, Wolkind; Ibid n 70.

making processes were not part of the research methodology, which would have enabled comparisons with other studies. As these inquiries continued until consensus was reached, it is possible that the identified mechanism of death was affected by pressure to agree or bias towards a binary decision when the best decision may have been that the cause of death could not be determined without independent corroboration. Moreover, as Cunliffe's analysis has demonstrated,[129] researchers and clinicians have struggled to identify reliable and specific indicators of covert homicide. The ongoing challenge is determining the proportion of SIDS that is actual SIDS and that which is recurrent covert homicide. Inadvertent inclusion of homicide deaths in studies of repeated deaths will lead to an overestimation of SIDS recurrence. At the same time, a family in which one SIDS death has occurred is theoretically at greater risk than other families of recurrence due to the shared genetic and environmental influences. Research needs to be done to distinguish between recurrent homicide and recurrent SIDS, albeit there are obvious limitations in reliably, independently identifying covert homicide when there are no obvious signs visible. In addition, theoretically it is possible to have one SIDS and then a covert homicide in one family. To date, the extent of the risk of another SIDS death cannot be quantified.[130] At best, the estimates calculated by Campbell and colleagues indicate that the recurrence risk of SIDS is higher in families with one SIDS and higher when the family is in the high-risk group. The prevalence of covert homicide has yet to be determined with any degree of reliability, despite Emery and his colleagues' work being quoted as confirmation of covert homicide.

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[129] Ibid n 15.
[130] Bacon, C.J, Hall, D.B.M, Stephenson, T.J, and Campbell, M.J, 'How common is repeat sudden infant death syndrome?' (2008) 93 *Archives of Diseases in Childhood* 323-326.

Carpenter and colleagues[131] is the largest prospective study into sudden infant death to date. The study was an 11-year follow-up of families in the CONI programme that supported families in which one SIDS death had already taken place. The English Foundation for Sudden Infant Death sponsored the CONI programme, with Emery on the steering committee. Once admitted on the basis of the first death, any events affecting subsequent children were included. Therefore, the CONI study followed *all* subsequent siblings, in an effort to understand genetic and other effects, whereas Meadow's study relied on referral-based case selection that is likely to be biased towards his views on covert homicide. Of the first 5000 babies enrolled in CONI, 44 babies died, of which 35 were unexpected deaths with nine of these deaths attributed to SIDS. Although participation in the CONI scheme was voluntary, the authors asserted that few families chose not to participate. Eighteen families in the programme had a second death attributed to SIDS, which yielded a relative recurrence risk of 5.9 compared to the population. However, in a similar vein to the limitations already noted in Emery and his colleagues' research cited as confirming covert homicide, the diagnostic accuracy of Carpenter's study has been questioned.[132] This is not surprising as any investigation or study that has to infer the mechanism of death is vulnerable to problems with diagnostic reliability and accuracy, as there is no independent verification of cause of death.

Bacon and colleagues[133] proposed three criteria for assessing the reliability of SIDS recurrence research: completeness and accuracy of ascertainment; thoroughness of death investigation and accuracy of diagnosis; and comparison with controls matched

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[131] Ibid n 116.
[132] Gornall, J, 'Was message of sudden infant death misleading?' (2006) 333 *BMJ* 1165– 8; Bacon, C, and Hey, E, 'Uncertainty in classification of repeat sudden unexpected infant deaths in Care of the Next Infant programme' (2007) 335 *British Medical Journal* 129–31.
[133] Ibid n 130.

for risk of SIDS. The authors reviewed eight population-based studies published in England since 1970, each study identified families who had experienced more than one SIDS death and their purpose was to estimate SIDS recurrence and each study was assessed on the basis of the three criteria.

The earliest reviewed study was in the late 1960s, when Forggatt and colleagues identified SIDS deaths and any previous siblings dying from SIDS in public records in Ireland.[134] Although SIDS was not registrable as a medical cause of death at the time, the case selection criteria were the same as current criteria. Data was gathered from parent recall of previous deaths in interviews and all deaths had undergone autopsies. The relative risk of recurrence, compared to the population and controls, was 3.7 to 9.6, which is similar to the findings of later studies.

Peterson and colleagues conducted two studies. In the first,[135] questionnaires were sent to American and some Canadian families who had lost an infant to SIDS. The cases were identified by voluntary organisations. The response rate is unknown and those with recurrent deaths may have been more inclined to respond, suggesting the sample may not have been representative which would inflate the recurrence risk. That is, those families who responded may have been unrepresentative and their individual risks may have been higher than families with one death. Recurrence was correlated with young maternal age and instability of family background. The risk in the next sibling was 8.6 compared to the population, while the risk to all subsequent siblings was 9.5.

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[134] Froggatt, P, Lynas, M.A, and MacKenzie, G, 'Epidemiology of sudden unexpected death in infants (‘‘cot death’’) in Northern Ireland' (1971) 25 *British Journal of Preventative & Social Medicine* 119–34.
[135] Peterson, D.R, Chinn, N.M, and Fisher, L.D, 'The sudden infant death syndrome: repetitions in families' (1980) 97 *Journal of Pediatrics* 265–7.

Peterson and colleagues' second study[136] was based on 15 years of public records in Washington State. They found the increase in the rate of recurrence in subsequent siblings was significantly smaller than in their first study. Further, when compared with controls matched for birth rank and maternal age, the rate of recurrence was not statistically significant. This finding may be explained by the fact that the researchers excluded sibships in which the father was unknown or different, thereby removing the possible genetic factors influencing subsequent SIDS deaths. This was done to focus the study on genetic influences on SIDS recurrence. However, this decision removed socially disadvantaged families who are most at risk for SIDS and thereby, reduced the number of reported recurrences.

Irgens and colleagues[137] used official records to identify repeat infant deaths in Norway over a 14 year period and found that SIDS rates among subsequent siblings of SIDS infants was four times that of the population overall. The autopsy rate was not reported but Norway was known to have a low autopsy rate at the time.

In South Australia, Beal and Blundell[138] collected data from health records and parent interviews to determine the incidence of SIDS in previous and subsequent siblings of SIDS victims over a 15-year period. The researchers included infants up to 2 years of age, instead of setting the usual upper limit of 12 months at age of death. This had the effect of elevating the overall recurrence rate, as recurrence was more frequent if the index baby was over 12 months of age at death, and 20% of second deaths were also in the older group. The categorisation as SIDS for infants over the upper limit of 12 months

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[136] Peterson, D.R, Sabotta, E.E, and Daling, J.R, 'Infant mortality among subsequent siblings of infants who died of sudden infant death syndrome' (1986) 108 *Journal of Pediatrics* 911–14.
[137] Irgens, L.M, Skjaeren, R, and Peterson, D.R, 'Prospective assessment of recurrence risk in sudden infant death syndrome siblings' (1984) 104 *Journal of Pediatrics* 349–51.
[138] Beal, S.M, and Blundell, H.K, 'Recurrence of sudden infant death syndrome' (1988) 63 *Archives of Diseases in Childhood* 924–30.

along with the absence of autopsies in some cases raises the possibility of wrong diagnoses and exaggeration of the reported SIDS recurrence rate. Further, repeat SIDS was isolated to a small subgroup, so the high recurrence rate may also reflect the higher initial SIDS risk of this particular group. The study identified two groups when recurrence risk was assessed: 92% of SIDS families' risk was less than twice the general population risk, while in the remaining 8%, the risk was 'significantly increased'. No homicides were found. However, Meadow criticised this study, without citing any empirical evidence, asserting that the mothers had killed some of the children.

Guntheroth and colleagues[139] used official data on births and deaths in Oregon and found that the risk of SIDS for next and for all subsequent siblings was five to six times that for the population. The autopsy rate was 90%. The risk did not change after adjusting for birth rank and maternal age.

Oyen and colleagues' study[140] overlaps the previous Norwegian study, Ingres' survey, in location and time but the design was different. The authors used official records to study all first and second babies born over a 22-year period. They found that the SIDS rate for second babies was nearly six times higher if the first baby's death was attributed to SIDS. The study matched babies with a control group matched for birth order but no other risk factors. The autopsy rate was low, 50% for first and 70% for second deaths. Consequently, diagnoses other than SIDS might have been missed, with resulting inflation of the SIDS recurrence rate.

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[139] Guntheroth, W, Lohmann, R, and Spiers, P, 'Risk of sudden infant death syndrome in subsequent siblings' (1990) 116 *Journal of Pediatrics* 520–4.
[140] Oyen, N, Skjaerven, R, and Irgens, L.M, 'Population-based recurrence risk of sudden infant death syndrome compared with other infant and fetal deaths' (1996) 144 *American Journal of Epidemiology* 300–5.

Carpenter and colleagues' CONI study is the largest prospective study to date and comes closer than previous studies in meeting Bacon et al's criteria. But no study of recurrence has matched controls for all risk factors.[141]

The main conclusions to be drawn from these studies is that having had one SIDS death and being in a high-risk family is likely to yield an elevated risk, as this estimate only applies to this subset of families and not the general population. The lack of matched controls is a core problem with these epidemiological studies, which are observational and descriptive in nature and cannot address the issue of causality.

2.4 Child abuse paediatricians and covert homicide

Alongside SIDS researchers' efforts to identify risk factors in SIDS, paediatricians concerned that children were victims of covert homicide were conducting their own research. From the early 1970s, there was increasing alarm in medical and welfare communities that children were being harmed and covertly killed without the perpetrator, usually a parent, being detected. In a sense, parents were getting away with murder. In the late 1980s, Meadow[142] reported that 2 – 10% of intentional smothering by mothers had been misdiagnosed as SIDS and invited an international debate on whether SUDI was attributable to SIDS or suffocation. It is likely Meadow was basing this estimate on Emery and colleagues' estimate.[143] Southall documented mothers harming their infants on covert video surveillance (CVS) while their infants were inpatients.[144] Southall's work was direct proof that covert homicides were taking place.

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[141] Bacon, C, 'Recurrence of Sudden Infant Death Syndrome' (2008) 122(4) *Pediatrics* 869-70.
[142] Ibid n 111.
[143] Ibid n 15.
[144] Southall, D.P, Plunkett, M.C.B, Banks, M.W, Falkov, A.F, and Samuels, M.P, 'Covert Video Recordings of Life-threatening Child Abuse: Lessons for Child Protection' (1997) 100 *Pediatrics* 735-760.

Pathologists, Byard and Krous observed that 'there is certainly no doubt that cases of infanticide and fatal accidents have been, and will continue to be, misdiagnosed as SIDS because of non-specificity of post-mortem findings and wide varieties of standard investigation of deaths among jurisdictions'.[145] However, the 1990's saw a rise in child protection awareness amongst paediatricians, and wider health and welfare services, without a critical approach to accurate detection of homicide.

In 1999, Meadow[146] published a retrospective, clinical case study documenting clinical features of 81 cases of infanticide that he believed served as 'markers' or indicators of fatal child abuse. Meadow claimed that these so-called markers differentiated between natural and unnatural death. Meadow argued that the very fact that smothering rarely leaves pathological fingerprints is the reason unnatural or imposed airways obstruction deaths are easily misattributed to SIDS. The cases were drawn from Meadow's clinical notes of the previous 18 years, which were referred to him by police, medical practitioners or social services, involving 50 families, half of whom had multiple intra-family deaths, and many of the deaths were initially diagnosed as SIDS. In 19 of the 50 families, a parent confessed to smothering or choking the child between five months to eight years after their deaths, usually during court proceedings.[147] Most of the infants were well in the 12 hours before death and Meadow comments 'the usual account of events was that the parent would discover the lifeless child, seek help from someone in the house of next door, telephone "999" for the

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[145] Byard, R.W, and Krous, H.F, *Diagnostic and medico-legal problems with sudden infant death syndrome.* (Totowa, New Jersey: Humana Press, 2004) 189-200.
[146] Ibid n 98.
[147] In a timely warning about confessions, Cunliffe found in her investigation of the cases in which Charles Smith gave evidence that eight parents (out of 24 wrongly accused) falsely confessed to crimes they did not commit. This raises concerns about the reliability of Meadow's case ascertainment. Cunliffe, personal communication, 2012.

emergency services and attempt resuscitation'.[148] Half of the sample was seen by hospital staff for unexplained medical emergencies, discharged and then died at home. Meadow observed that 77/81 cases had available post-mortem examinations but were of variable quality, despite which he concluded, 'Most of the deaths are likely to have been caused by smothering'.[149] Meadow argued that psychosocial factors are more instructive than pathological post-mortem findings in detecting covert homicide. However, he did not suggest how to avoid 'false positives' (wrongly attributing a death to homicide when the death is natural), as the thrust of his paper was that paediatricians were better equipped to detect child homicide than pathologists. Meadow seemed to place greater weight on psychosocial factors than pathological findings in determining whether an infant was murdered. Psychosocial circumstantial factors are even more ubiquitous or unable to distinguish between homicide and other cases than physical indicators. Cunliffe has argued that a strong desire to convict 'guilty' parents is an underlying belief that explains physicians' reliance on psychosocial factors to establish homicide, in the absence of specific physical indicia of murder.[150] Cordner has also observed that physicians might have a strong desire to convict guilty parents because the worst mistake a clinician can make is to return children to abusive carers.[151] In contrast, the worst mistake a pathologists can make is to be associated with a wrongful conviction.

Meadow's study is problematic for several reasons. Retrospective studies have the inherent problem of hindsight bias: that is, reviewing the case features with the (biased) knowledge that a catastrophic event has occurred. This can be obviated by

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[148] Ibid n 98, 9.
[149] Ibid n 98, 11.
[150] Cunliffe – personal communication, 2012.
[151] Cordner – personal communication 2013.

measures such as the use of blind ratings of the facts in the case and providing information on all known facts of the case, not only facts indicating suspicion. The sample is not representative of a cross-section of the population of infants, which would allow conclusions to be drawn about the base rate (prevalence) of particular physical findings, as well as psychosocial factors. Knowing the base rate of any given factor (e.g. post-mortem findings of petechial spots on the lungs or the infant's death in the mother's care) assists in determining whether the factor differentiates homicide from natural or unexplained death. For instance, a study comparing Meadow's case features with that of 165 cases of SIDS in the Republic of Ireland between 1994 and 1997 found that factors such as death in the first seven months of life was so common within the study population (91% of sample) as to negate its use as a marker of infanticide.[152] Interpreting ubiquitous facts as incriminating in the context of an unexplained infant death is engaging in hindsight bias, which makes it unlikely that reliable evidence of events preceding the infant's death will be uncovered, especially rare medical diseases or disorders.

As Meadow's study draws its sample from his selected clinical cases, and then only the ones that have come to legal notice, the relevance of his observations to other situations is limited. Pathological specimens were not, as Meadow acknowledged, re-analysed and the study relied on the post-mortem reports of pathologists from various areas of the UK. There was no standard protocol, which would allow a valid comparison between these cases and other SUDI cases. For these reasons, the conclusions of Meadow's papers need to be interpreted with caution. There is little doubt that parents can and do murder their infants but studies such as this do not provide a basis for accurate

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[152] Mehanni, M, McDonnell, M, and Matthews, T, 'Infanticide or SIDS, double jeopardy' (2000) 82 *Archives of Diseases in Childhood* 336.

identification of those cases that are instances of homicide. The challenge for society and justice is to identify homicide in a demonstrably reliable manner.

Alongside the developments in child abuse paediatrics, an infamous rule, incorrectly called 'Meadow's Law', came into existence. The 'law' or rule, originally proposed by DiMaio and DiMaio, stated

> *It is the authors' opinion that while a second SIDS death from a mother is improbable, it is possible and she should be given the benefit of the doubt. A third case, in our opinion, is not possible and is a case of homicide.*[153]

The criticism levelled at the rule is that neither DiMaio and DiMaio, nor Meadow, substantiate their claims with empirical evidence, whether in the form of case studies, or other research.[154] Later research raised serious doubt about Meadow's claim that recurrent SIDS in the same family was 'extremely rare' and likely to be unnatural.[155] On the contrary, Carpenter and colleagues' follow-up study of SIDS families found two or more deaths in the same family to be 'not uncommon' with the overwhelming majority (80–90%) due to natural causes.[156] There are, it has subsequently emerged, several genetic mechanisms that could account for recurrent SIDS including congenital viscero-autonomic dysfunction and cardiac dysrhythmias.[157]

At this point it is worth reflecting on the interpretation of evidence. Emery had felt that the mechanism of death could not be objectively determined and consensus among professionals was a solution to this problem. It is not the case that objectivity *is*

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[153] DiMaio, D.J, and DiMaio, V.J.M, *Forensic Pathology* (Elsevier, St. Louis MO, 1989) 291.
[154] Ibid n 122.
[155] Ibid n 122.
[156] Ibid n 116.
[157] Obtal, S.H, and Rognum, T.O, 'New insight into sudden infant death syndrome' (2004) 364 *Lancet* 825–6; Goldhammer, EI, Zaid, G, Tal, Y, et al, 'QT dispersion in infants with apparent life-threatening events syndrome' (2002) 23 *Pediatr Cardiol* 605–7.

achievable or that *only* objective evidence is reliable. While the debate about the relative merits of subjective and objective forms of proof and evidence continues, Popper's warning about objectivity being an 'idol' is worth remembering.[158] The search to accurately identify causes of SUDI, and specifically, SIDS, should not obscure the fact that *all* knowledge, in whatever form it is perceived, has subjective and objective elements. However, SUDI has been characterised by an over-reliance on clinical, subjective opinion evidence at the expense of objective, transparent, demonstrably reliable methods of detecting infant homicide. The lack of transparency and, consequently, generalisability of methods of detecting homicide is no more apparent than in SIDS and smothering research. While the nature of proof of homicide does not have to fulfil idealised notions of scientific objectivity, the proof has to be based on reliable theoretical, empirical or clinical evidence with independent verification that the particular death was indeed a case of homicide. This standard is essential in the interests of accuracy and, should the case become a criminal matter, affects the admissibility of the opinion.

The heightened consciousness about child abuse and homicide, in both overt and covert forms, in social, professional and welfare communities by the 1970s was not matched by a rigorous and critical analysis of presenting signs nor a search for alternative explanations such as known and unknown causes of injury. The 'subjective experiences of conviction'[159] has led many medical experts to assume that they are able to reliably identify undetected homicides wrongly classified as SIDS. The current state of medical knowledge does not support this view and it is an inaccurate depiction of

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[158] See Chapter 1.1 on EBM and medical evidence.
[159] See Ibid n 60; see generally 'illusions of validity (accuracy)' in Chapter 7.

what is possible to achieve in medical investigation of SUDI. SIDS means the mechanism and medical cause of death has not been identified and there is no evidence that it is not natural. However, a classification of SIDS does not exclude homicide by smothering. A resounding message from the current medical research is the need for critical analysis of evidence and conclusions when investigating alleged smothering cases. Evidence leading to forming medical opinion that an infant died from inflicted mechanisms must be transparent and based on the best evidence possible, accompanied by a willingness on the part of medical experts to admit that sometimes the mechanical cause of death is not known. Suspicions of homicide are not an appropriate substitute for reliable evidence of homicide.

2.5 Conclusions

This chapter examined the complexities associated with investigating sudden infant death in infancy (SUDI) due to apparent SIDS or smothering. SIDS is a category assigned when a thorough death investigation fails to reveal a mechanical and medical cause of death in an infant. The term SIDS means the cause of death has not been identified and there is no evidence that it is other than natural. In the event that there is actual evidence to suspect the death might be homicide, the death would not be classified as SIDS. Rather, the death would likely be classified as unascertained instead of SIDS.

The medical challenge in cases suspected of being homicide deaths is differentiating between SIDS and deliberate smothering. Identifying whether a death is SIDS or smothering is difficult given that there is rarely positive pathology evidence indicating the mechanism of death. The clinical researchers involved in investigating these types of deaths were Emery and his colleagues. Emery was a pathologist primarily interested in understanding SIDS and providing answers and support for bereaved

families. Emery proposed that a percentage of deaths classified as SIDS were more accurately described as covert homicide. He suggested that between 2 – 10% of SUDI might be homicides, after extensive multi-disciplinary death investigations. He was cautious and placed caveats on his proposal. Emery confirmed the suspected covert homicides from confessions and confidential inquiries involving a multi-disciplinary team that relied on psychosocial as well as medical evidence, and met until consensus was reached. The reliance on psychosocial factors, such as quality of parental relationship, bond with the infant and financial and other stress, is of dubious value as none of these factors discriminate between homicide and other causes of death. A thorough examination of Emery's research methodology indicates that there was no independent verification that his cases of suspected homicides were actually homicide. The law professor, Emma Cunliffe, concluded from her extensive analysis of medical literature that suspicion that a death is a *probable* homicide has been conflated with the level of proof needed for a criminal conviction.[160] The fact that medicine has not identified a mechanical or medical cause of death does not mean the death is not homicide. Similarly, a criminal conviction also does not prove the death was homicide as such convictions were secured on the basis of medical opinion evidence from paediatricians who claimed the death was homicide. This constitutes circular reasoning and unjustifiably shifts suspicion to proof of homicide.

Although Emery himself was cautious in his suggestions about covert homicide, subsequent writers in medical, legal and welfare literature cited his figures as proof that covert homicide occurred at a rate of 2 – 10% in any infant death population, indicating that covert homicide was going undetected and failing to be prosecuted.

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[160] See Ibid n 15, Cunliffe, Chapter 4.

Physicians such as Meadow and DiMaio relied on Emery's figures to justify their own agenda about mothers 'getting away with murder', inventing the infamous, if misnamed, 'Meadow's Law'. There is, however, no evidence in the empirical literature supporting these assertions. It is likely that proponents of undetected covert homicide transformed ambiguous medical evidence of smothering from suspicion to certainty by reference to equally ambiguous psychosocial characteristics of the suspected perpetrator of covert homicide. Meadow exemplifies the view that covert homicide is detectable through analysis of psychosocial factors – indeed that reliance on these variables is more likely to identify homicide than inconclusive pathology findings. Arguably, non-significant medical results might indicate that death is not a case of homicide. Similarly, the confidential nature of Emery's inquiries makes it impossible to discern the reliability of judgments of covert undetected homicide made in that context. Extrapolating from Emery's inquiries to other cases where homicide is suspected is not safe and likely to be prone to error.

Medical research has examined whether SIDS is a one-off occurrence or whether it can recur in families, suggesting a shared genetic and/or environmental connection between the deaths. SIDS recurrence studies have demonstrated that, although rare, multiple SIDS deaths do occur in some families. These studies suggest that a second or even third death from unexplained causes can occur in one family. However, as a diagnosis of SIDS does not exclude covert homicide, it is possible that a given SIDS death might actually be smothering (accidental or homicidal). Whether these subsequent deaths are attributed to SIDS, rare medical conditions or smothering depends on the findings of each death investigation. Investigations are limited by the lack of an objective standard against which a diagnosis or classification of covert homicide can be measured. In sum, SIDS simply means the cause of death is undetermined or

unascertained where 'cause' refers to both the medical cause and the manner of death (homicide, accident, natural). If there were evidence that a death constituted a probable homicide, but there was insufficient evidence to be classifying it as homicide, the death would be classified as unascertained, not SIDS. In the context of criminal trials for homicide, the studies are important as they suggest that multiple unexplained deaths can occur in one family. Compared to the general population, the risk of another SIDS death is higher in a family that has already had one SIDS death, and the risk is even higher in families with a trio of risk factors identified by the CESDI study: maternal age < 25 years, multi-parous mother, and no waged income. As the diagnosis of SIDS does not rule out covert homicide, the possibility that each death in a family with recurrent SIDS might be due to smothering remains. However, moving the classification of the death from possible or probable homicide to confirmed homicide depends on positive physical findings of inflicted death, which is often absent.

It is possible to conclude, at least in general terms, that SIDS is poorly understood, and smothering and recurrent SUDI even more so. There are many known and unknown diseases and disorders that can lead to sudden infant death and it is rare for a death investigation to conduct *all* possible tests.[161] Physicians have argued that covert homicide is the likely explanation when deaths are unexplained by autopsy and typical post-mortem investigations. But statisticians, such as Hill, and SIDS recurrence researchers such as Emery's colleague, Carpenter, emphasise that multiple homicide is also rare and should not be the main theory when deciding whether a death is an instance

[161] Some tests might be impossible to conduct, such as rare cardiac conduction disorders. The death might be due to unique genetic mutation not previously described, and therefore difficult to detect, and, if detected, it is difficult to establish that the mutation was exerting potentially fatal effects in a particular case.

of homicide. Carpenter and others have shown that recurrent SIDS deaths do occur and genetic or other unknown factors may explain recurrent deaths. In the absence of positive autopsy findings, after conducting a thorough death investigation, concluding a death constitutes homicide is unjustified. Emery's reliance on confidential inquiries of unknown content that lacked transparency about how decisions about the mechanism of death were made renders death classification in this context unreliable. The research designs used in SUDI research are prone to selection bias and the reliability and accuracy of mechanism of death assignment has not been established. Confidential inquiries aimed at consensus are not an acceptable substitute for independent corroboration of the mechanism of death.

The work of Emery, and other SIDS researchers such as Carpenter, suggests that most sudden infant deaths might be natural. A cautionary point, however, is whether a death or recurrence is *actually* due to natural causes or covert homicide remains difficult to prove with any degree of accuracy in the absence of positive autopsy results and eyewitness(s) to the events preceding death. In high-risk families that have already had one death, it is possible that another death can occur. However, assertions that covert homicide is undetected and unprosecuted are not supported by the existing literature and run the risk of wrongly accusing and convicting innocent parents and carers. In order to understand the characteristics of recurrent intra-family sudden infant death, prospective studies are needed, following all infants from birth on relevant physical (such as brain, ocular and respiratory functioning) and psychosocial variables across, preferably, multiple hospitals in several countries. The more difficult issue is proving covert homicide and its recurrence. This depends largely on reliable evidence of events in the hours and days before signs developed, which in turn depends on valid and reliable witnessed events. Although a prospective study would not address the issue of covert

homicide, there is a greater potential for closely following infants' development and families across time, which might create opportunities for detecting abnormalities in both physical and psychosocial measures in infants.

Chapter 3: Appellate cases regarding smothering

This chapter examines recent criminal court appellate cases concerning medical opinion evidence on recurrent sudden unexplained death in infancy (SUDI). As the preceding chapter suggests, there are no reliable physical indicators of smothering and fears that covert homicide is undetected are not supported by empirical research. A multitude of known and unknown medical disorders and diseases could explain SUDI and homicide is by no means the obvious conclusion when post-mortem examination does not reveal significant findings. In the medical literature, confirmations of homicide are based on confidential inquiries incorporating medical and psychosocial assessment of the family, and agreement, as opposed to independent corroboration of homicide. Psychosocial characteristics (e.g. maternal presence at death scene, relationship stress) are ubiquitous and less likely to differentiate between homicide and other causes of death than physical findings. There is a risk that unfairly prejudicial meaning will be assigned to potentially related but diagnostically irrelevant psychosocial evidence. As the following discussion will suggest, courts have admitted unreliable medical opinion evidence that overstates the extent to which medicine (and psychosocial assessments) can account for a SUDI or recurrent SUDI. These cases represent failures of medicine and law to properly address the reliability of medical opinion evidence. The cases occurred in England and Wales, Australia and Canada.

3.1 England and Wales

In England and Wales, the quashing of the convictions of Sally Clark[162] and Angela Cannings[163] were a turning point for medical and legal communities involved in dealing

[162] Ibid n 8, *Clark*.
[163] Ibid n 8, *Cannings*.

with SUDI. These cases focussed attention on the capacity of both disciplines to reliably determine when a death constitutes homicide. Clark and Cannings, like other convicted parents or carers, consistently asserted that they had not harmed their infants, a position that did not change throughout their trials and appeals. In these cases, the evidentiary issue was whether medical opinion evidence, along with other evidence, established the infant was murdered by being deliberately suffocated. Determining the mechanism of death in these cases is particularly challenging as there is limited, if any, medical evidence. The reliability of medical opinion evidence is unclear given the contradictory and equivocal research and clinical knowledge upon which such opinion is based. As the appeals reveal, all too often, medical experts expressed their opinions with greater certainty than is justified. Perhaps more importantly for the criminal justice system, the prosecution adduced inconsistent, overstated or unreliable medical evidence that was not exposed by legal safeguards such as cross-examination and judicial directions.

3.1.1 R v Clark [2000][164]

Sally Clark was convicted in November 1999 for the murder of her infant sons, Christopher, aged 11 weeks, and Harry, aged 8 weeks. Clark was a solicitor who had a good reputation. Christopher was a healthy baby but died suddenly while in Clark's care on 13 December 1996. Dr Williams conducted the autopsy and concluded that Christopher died from a lower respiratory tract infection. Christopher had bruising that was attributed to resuscitation attempts. The death was treated as a SIDS death. Christopher's body was cremated, although slides of his lungs were retained. In January 1998, Clark's second child, Harry, died at home while in Clark's care, although her

[164] *R v Clark* [2000] EWCA Crim 54 2 October 2000.

husband was at home as well. The Clarks participated in the Care of Next Infant programme (CONI) and received counselling. Williams again conducted the autopsy and concluded that Harry had died from non-accidental injuries consisting of shaking on several occasions across several days. Subsequently, Williams conducted more tests on Christopher's slides and concluded that his death was also unnatural and suggestive of smothering. Clark was charged with murder of the two infants.

The prosecution case was that Clark had smothered Christopher and killed Harry by shaking him. Williams revised the cause of each death to homicide, stating he had found old injuries in Harry. The prosecution argued it was beyond coincidence that two infants had died naturally and the fact of each death was inculpatory evidence that the other death was homicide. The deaths were tried together in joinder of charges. Psychosocial factors of unknown inculpatory significance were prominent, as was shifting medical opinion on the mechanism of death in each infant's case once both infants had died.

The Crown relied on circumstantial evidence that there was similarities between the two deaths indicating both infants were murdered. The similarities were: (1) The infants were similar ages when they died, (2) Clark found them unconscious in the same room, (3) Both were found at the same time, shortly after being fed, (4) Clark was alone with the infants when she discovered them lifeless, (5) Mr Clark was away or about to go away, and (6) In each case there was evidence of previous abuse.

In Harry's case, the prosecution asserted he had hypoxic brain damage, cerebral and retinal haemorrhages, and retinal petechial haemorrhages, healing rib fractures, spinal bleeding and a swollen spinal cord. Professor Meadow testified that SIDS could be distinguished from unnatural death by the presence of previous unusual apnoeic episodes, inconsistent parental account of events preceding death and both deaths

occurring after being fed in the evening. Based on a draft report of the Confidential Enquiry into Stillbirths and Deaths in Infancy (CESDI), Meadow testified that the chances of a second SIDS death in a family that matched Clark's profile was 1 in 73 million, after squaring the incidence of one death.

Clark insisted she had not harmed her children. Clark's defence focussed on the questionable reliability of Williams' opinion, as he completely changed his original interpretation of Christopher's autopsy results. Relying on CONI (instead of CESDI) figures, one defence expert testified the risk of recurrence was greater after one SIDS death. The defence argued that Williams' list of inflicted injuries on Harry was a point of disagreement between the experts and many were unconfirmed. Clark's inability to explain the (revised) medical findings and inaccuracies in Mr Clark's account of the time of his arrival home were held as highly significant and indicative of deception.

Clark appealed her conviction twice. The first appeal included Meadow's misuse of statistical evidence.[165] The appeal was dismissed because of similarities between the deaths: that is, Clark's presence, the infants' similar age at death, being well before being found moribund, Mr Clark was away or going away, inflicted injuries (which experts did not agree about), and the rarity of two natural deaths in one family with the listed features and the unlikely coincidence of both children having old and recent injuries.[166] The statistical evidence point was held as irrelevant, as the jury faced an overwhelming case against Clark, in which guilt was the proper verdict.

Clark successfully appealed on a second occasion[167] on two grounds. The first related to pathology evidence withheld by Williams, discovered by Clark's father and

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[165] Ibid n 164.
[166] Ibid n 164, 255.
[167] Ibid n 8, *Clark*.

husband when they examined Williams' files. Microbiological tests showed Harry had colonisation of staphylococcus aureus, suggesting that he may have died from natural causes. Williams had not disclosed the evidence to the defence, prosecution, other medical witnesses, or police. There were, therefore, physical findings that could explain Harry's death, which cast doubt that Clark had inflicted the fatal injuries, making the verdict unsafe. The Court held:

> *...[the expert's] failure demonstrated that he had fallen a very long way short of standards to be expected of someone in his position upon whose evidence the court was inevitably going to be dependent.*[168]

In June 2005, the General Medical Council found Williams guilty of 'serious professional misconduct' in the Clark case and he was banned from Home Office pathology work and coroner's cases for three years. This decision was upheld by the High Court in November 2007.

The second ground for appeal was Meadow's statistical testimony in which he erroneously assumed SIDS recurrence was not correlated with genetic or environmental factors. The Court observed it was 'unfortunate that the trial did not feature any consideration as to whether the statistical evidence should be admitted in evidence'.[169] The Court repudiated the expression of remote possibilities in stark statistical terms and accepted the figure of 1 in 73 million 'grossly' misrepresented the likelihood of SIDS recurrence from unexplained but natural causes.[170] The Court considered Meadow's testimony comparing the likelihood of SIDS recurrence to the chances of 'backing long

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[168] Ibid n 8, *Clark*, 164.
[169] Ibid n 8, *Clark*, 173.
[170] Ibid n 8, *Clark*, 178. The CESDI data Meadow relied on was accompanied by a warning the data did 'not take account of possible familial incidence of factors other than those included' (101).

odds winners on the Grand National year after year', as compelling in the jury's deliberations (despite the trial judge's downplaying this aspect of testimony). It held that, if the admission of statistical evidence had been fully argued at the first appeal, it would have been a distinct basis for allowing Clark's appeal.[171] Although the trial judge attempted to mitigate the significance of the statistical evidence, and gave directions on the dangers inherent in the way the figure of 1 in 73 million had been reached,[172] Meadow had been permitted to express misleading opinion on the likelihood of SIDS recurrence.

Clark's successful appeal was based on Williams' unequivocal breach of professional conduct and the Court's acceptance that Meadow had grossly overstated the rarity of SIDS recurrence. The issue of reliability of medical opinion was resolved because both experts' evidence was deemed unreliable and unfairly prejudicial. However, neither error was discovered through medical or legal regulation or overview of the accuracy of medical opinion. Rather, it was the persistence (and resources) of Clark's family that uncovered the wrongful conviction.

3.1.2 R v Cannings [2004][173]

In 2002, Angela Cannings was convicted of murdering two of her four infants, Jason and Matthew, by smothering. Cannings' first-born child, Gemma, had also died at 13 weeks of age (some 10 years ago) but the prosecution of her death had not proceeded.[174] The remaining infant, Jade, survived an acute or apparent life threatening event (ALTE) at age 11 weeks from which she fully recovered. All four children had suffered ALTE's.

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[171] Ibid n 8, *Clark*, 178 -180.
[172] Ibid n 8, *Clark*, 104 and 106.
[173] Ibid n 8, *Cannings*.
[174] Ibid n 8, *Cannings,* 2. At the time she was charged with the murder of Jason and Matthew, Cannings was also charged with Gemma's murder by smothering but the allegation did not proceed, seemingly because a thorough death investigation had classified the death as SIDS.

Cannings denied killing her children. The Crown adduced medical evidence about the inculpatory interpretation of three infant deaths in the same family. There were also inconsistencies in Cannings' account of the ALTEs, which only occurred when the infants were in Cannings' care, which were held as inculpatory.

Cannings successfully appealed her conviction in 2004, based on medical evidence that there was a family history of SIDS.[175] Fresh medical evidence, based on the CONI study suggested recurrent SIDS could have underlying genetic causes and this may have been in the case in Cannings' family. There was extensive evidence of ALTEs and apnoea across generations of Cannings' family, suggesting an inherited condition, which presented an alternative explanation for Cannings' infants' deaths.

The Court acknowledged there was a 'substantial body of research' indicating infant deaths 'can and do occur naturally, even when they are unexplained'.[176] The Court held that if each death was unexplained, then recurrence did *not* inexorably mean death constituted homicide. The Court held:

> *Whether there is one, two or even three deaths, the exclusion of currently known natural causes of infant death does not establish that the death or deaths resulted from the deliberate infliction of harm. That represents not only the legal principle, which must be applied in any event, but, in addition…at the very least, it appears to us to coincide with the views of a reputable body of expert medical opinion.*[177]

Meadow's testimony in *Cannings* did not rely on statistical evidence. However, the scientific basis for his opinion that recurrent SUDI constitutes homicide was criticised. The prosecution had asserted the infants were likely smothered because they died whilst

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[175] Ibid n 8, *Cannings*.
[176] Ibid n 8, *Cannings*, 138.
[177] Ibid n 8, *Cannings*, 13.

in Cannings' care. Meadow testified recurrent SUDI in similar circumstances in the presence of the same person was inculpatory.[178] Finding there was significant risk of error when a case relied primarily on medical evidence, Lord Justice Judge read down:

> *In cases like the present, if the outcome of the trial depends exclusively or almost exclusively on a serious disagreement between distinguished and reputable experts, it will often be unwise, and therefore unsafe, to proceed.*[179]

In quashing Cannings' conviction, the Court held the mere fact of two or more SUDI in the same family did not lead inexorably to the conclusion that the deaths constitute homicide, contrary to the view or 'dogma' (Meadow's law) amongst a number of expert paediatricians.[180] The Court held that, if all known causes of death were excluded, the cause of death remained unascertained. Accordingly, parents should not be prosecuted if experts disagree over causation and there was no other cogent evidence to suggest murder.[181] The Court concluded that:

> *If murder cannot be proved, the conviction cannot be safe. In a criminal case, it is simply not enough to be able to establish even a high probability of guilt. Unless we are sure of guilt the dreadful possibility always remains that a mother, already brutally scarred by the unexplained death or deaths of her babies, may find herself in prison for life for killing them when she should not be there at all. In our community, and in any civilised community, that is abhorrent.*[182]

The judgment exposed the difficulty courts experience in resolving conflicting medical opinion proffered by reputable and persuasive experts. Expert evidence is admitted as

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[178] See also ss 98, 97 of Uniform Evidence Act 1995; *R v Gilham* [2009] NSWSC 138.
[179] Ibid n 8, *Cannings,* 178.
[180] Ibid n 8, *Cannings*, 18-20, referring to 'Meadow's law'. See also Ibid n 5, *Anthony*.
[181] Ibid n 8, *Cannings*, 178-179.
[182] Ibid n 8, *Cannings*, 178-179.

an exception to the presumptive exclusion of opinion evidence. Courts rely on experts to provide impartial testimony that explains the basis of their opinion and limitations of their field and knowledge. In *Clark* or *Cannings*, experts have failed to enact their duty to the Court. In the common law jurisdictions of England and Wales, Canada, and Australia, there is no requirement to assess the reliability of expert evidence. Once admitted to trial, medical opinion evidence is difficult to manage as assumed legal safeguards – such as cross-examination and defence experts – have failed to convey problems with this type of evidence.

In *Cannings*, the court's evaluation of expert evidence included the expert's performance in previous trials, not merely his reputation. For example, Meadow's flawed testimony in *Clark* was judged as follows:

> *...notwithstanding his pre-eminence, at least part of his evidence in the Sally Clark case was flawed in an important respect. To some extent at least, Professor Meadow's standing as a witness would have been reduced. Therefore the flawed evidence he gave at Sally Clark's trial serves to undermine his high reputation and authority as a witness in the forensic process. It also, and not unimportantly for present purposes, demonstrates not only that in this particular field which we summarise as 'cot deaths', even the most distinguished expert can be wrong, but also provides a salutary warning against the possible dangers of an over-dogmatic expert approach.*[183]

The judiciary has not assessed the reliability or merits of the content of Meadow's testimony. Rather, it has relied on a seemingly more superficial assessment of his reputation and the effect of his previous testimony on the testimony under appeal. While *Cannings* suggests that renowned experts can be judged to be wrong by appellate courts,

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[183] Ibid n 8, *Cannings*, 17.

neither the judiciary nor the medical community had oversight mechanisms to identify significant errors in medical opinion evidence in *Clark* or *Cannings* before, during or after the trials. In Canning's case, her compelling genetic history made it impossible to continue to uphold her conviction. Appellate courts are reliant on trial evidence, often lack guidance from medical experts about *how* to assess their testimony for reliability or accuracy, and are vulnerable to incomplete disclosure by experts. The *Cannings* court aptly described the challenge for the fact-finder – and the Court – faced with conflicting expert testimony:

> *We have some sympathy for the jury. We have to reflect an anxiety which has struck us throughout our own deliberations, whether notwithstanding these clear directions, the whole course of the trial, the sheer number of experts called by the defence, and the complex specialist fields in which these distinguished men and women worked, the jury may not, inadvertently, unconsciously, have thought to itself that if between them all, none could offer a definitive or specific explanation for these deaths, the Crown's case must be right.*[184]

These comments highlight challenges in resolving disputes between experts in areas about which the jury or judge is unfamiliar, hence the need for expert testimony in the first place. Without a reliability standard imposed during admissibility determinations, it is difficult to see how existing legal evidence management mechanisms could reveal the significant problems in medical opinion on the mechanism of death in SUDI.

3.1.3 R v Anthony [1998]

In 1998, Donna Anthony was convicted of murdering her two infants, Jordan, aged 11 months and Michael, aged 4 months, and sentenced to life imprisonment on each

[184] Ibid n 8, *Cannings*, 171.

count.[185] Anthony maintained she had not harmed the children and they must have died naturally. The prosecution argued that Anthony had killed her infants by smothering them. The initial medical evidence indicated that Jordan's death was a SUDI and that nothing untoward was suspected. During the trial, the pathologist changed his opinion and described the mechanism of death as 'unascertained'. After Michael's death, another paediatric pathologist, Professor Berry, reviewed the post-mortem findings for Jordan. Berry suggested that if the death of each child was looked at in isolation from the other, the deaths were properly described as unexplained or unascertained, but not SIDS deaths. However, Berry concluded the 'possibility of one mother having two unexplained deaths, in other words, lightning striking twice, was most unlikely and outside his experience'.[186] Berry testified it was most likely that both babies had been suffocated. He recommended paediatricians who specialised in infant death and child abuse to review the deaths. Meadow was consulted. He examined the medical and social services records and the post-mortem results for each infant. Meadow concluded both infants' deaths were typical of smothering. He also categorised the deaths as Munchausen Syndrome by Proxy (MSbP), asserting the children were smothered so Anthony could gain attention. Before the trial, the MSbP diagnosis was excluded on appeal and he was permitted to testify only on the clinical findings.

Anthony appealed twice. The unsuccessful 2000 appeal was based on two grounds: one relating to bias in Meadow's judgment given his (excluded) evidence of MSbP, and the other to evidence of diminished responsibility and changing the conviction to manslaughter. There was psychiatric and psychological evidence, obtained

[185] Ibid n 8, *Anthony*.
[186] Ibid n 8, *Anthony*, 59.

after the conviction, that Anthony had Histrionic Personality Disorder but whether this disorder impaired her judgment to the extent of killing her infants was not agreed. The appeal was dismissed.

In 2005, the Criminal Cases Review Commission, which was investigating all cases in which Meadow testified, referred Anthony's case to the Court, leading to the second appeal. The court distinguished Anthony's case from *Cannings*, as the conviction did not depend exclusively, or almost exclusively, on a disagreement between distinguished and reputable experts. The court also reviewed circumstantial evidence, including inconsistencies and contradictions in Anthony's accounts of the deaths; Anthony's unwillingness to change problem behaviours on advice of her health nurse (smoking inside the house, reducing the room temperature); initial difficulties in bonding; having her mother care for Jordan for up to two weeks, and expressed anger and hostility towards the children.

Meadow was again the subject of censure by the Court. Meadow's testimony that there were 'such incredibly long odds' against two children in the same family dying of natural unexplained causes,[187] obtained by multiplying the chances of single deaths was again disputed[188] and viewed as 'flawed statistical evidence'.[189] The Court added that Meadow's testimony would be open to criticism:

> *...not least because of the flawed statistical evidence he gave at the trial of Sally Clarke, which, again as was noted in Cannings, served to undermine his reputation and his general authority as a witness. In short, in highly material respects confidence in statistical, or semi-statistical, if*

[187] Ibid n 8, *Anthony*, 92.
[188] Ibid n 8, *Anthony*, 69.
[189] Ibid n 8, *Anthony*, 85, 92.

that is the appropriate way to describe the use of the word 'odds', evidence given by the two most important medical experts called by the Crown is now significantly undermined.[190]

The judgments in *Clark* and *Cannings* and the findings of the Criminal Cases Review Commission proved fortuitous for the *Anthony* appellate court. The Court needed to decide whether to accept or reject the findings of the previous appellate courts and the Commission. This simplified their task, as it is unclear whether the Court could have analysed the content of conflicting expert opinion, particularly whether it was reliable. In addition, a collaborative report from three medical experts providing their opinion on the findings in the infants' deaths was tendered to the Commission. The experts described their areas of agreement and disagreement. The report provided a joint opinion on the medical findings alone for each death, ignoring Anthony being a 'wholly unreliable informant',[191] and concluded 'unnatural death was not the only conclusion which could be drawn'.[192] That is, the experts believed there was reasonable doubt that the deaths resulted from smothering. Anthony's conviction was quashed, uncontested by the Crown. She had served seven years in prison. As in *Clark* and *Cannings*, psychosocial facts were interpreted as inculpatory and bolstered a prosecution based on equivocal medical evidence. These facts were viewed in the original trial as cogent evidence supporting a guilty verdict.

3.1.4 R v Kai-Whitewind [2005][193]

In 2005, after the successful *Clark* and *Cannings* appeals, Kai-Whitewind lost her appeal against conviction for murder. Although a case of a single death, the appellate judgment

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[190] Ibid n 8, *Anthony*, 92.
[191] Ibid n 8, *Anthony*, 93.
[192] Ibid n 8, *Anthony*, 93.
[193] Ibid n 8, *Kai-Whitewind*.

in *Kai-Whitewind* was important in reading down the extent to which the judgment in *Cannings* would be applicable to other SUDI trials.

In 2003, Chaha'Oh-Niyol Kai-Whitewind was sentenced to life imprisonment for murdering her 12-week old son, Bidziil. The prosecution's case at trial was that Kai-Whitewind killed baby Bidziil by asphyxiation after becoming frustrated with his refusal to breastfeed. Kai-Whitewind asserted her innocence throughout her trial. Bidziil, Kai-Whitewind's third child, was conceived from an alleged rape. Kai-Whitewind became depressed after birth and revealed to a nurse that she had a fleeting moment when she felt like killing Bidziil. Just before Bidziil's death, she sought medical advice regarding two incidents of vomiting and a spontaneous nosebleed. The first post-mortem examination revealed old blood in the lungs consistent with two distinct episodes of upper airway obstruction. The prosecution relied on the findings of a second post-mortem examination, in which their expert concluded that the immediate cause of death was lack of oxygen or asphyxiation. Apart from the spontaneous and unexplained nosebleed, there was old and fresh bleeding in the lungs. Another expert concluded that the bleeding was most likely due to upper airways obstruction. The defence relied on the conclusion of the first post-mortem that the mechanism of death was 'unascertained' and the opinion of a paediatric pathologist that death by natural causes was more probable than an unnatural death.

In rejecting Kai-Whitewind's appeal, the court noted there was disputed evidence of the mechanism of death between reputable experts, as in *Cannings*, but in this case these disagreements did not preclude conviction. The court held that, on its own, the medical disagreements did not render the verdict unsafe, as it is the role of the jury to evaluate expert evidence and deliberate on the testimony of forensic pathologists. Judge LJ said:

> *In Cannings there was essentially no evidence beyond the inferences based on coincidence, which the experts for the Crown were prepared to draw. Other reputable experts in the same specialist field took a different view about the inferences, if any, which could or should be drawn. Hence the need for additional cogent evidence. With additional evidence, the jury would have been in a position to evaluate the respective arguments and counter-arguments: without it, in cases like Cannings, they would not.*[194]

The defence appealed on the basis the *Cannings*' judgment applied to other SUDI cases in which there is a conflicting expert opinion. The conviction was unsafe because the jury was exposed to conflicting expert opinions as to whether natural causes of death could be excluded; there was no independent evidence of guilt; any assessment by a jury based on the relative performance of disputing experts renders any conviction unreliable; and an accurate verdict was unlikely, without independent evidence, in a case where the state of scientific knowledge is still developing. The Crown contested the appeal, rejecting the death as a case of SUDI or SIDS. It submitted there was evidence, outside medical evidence, which enabled the jury to convict. Kai-Whitewind had trouble bonding with Bidziil and had possibly delayed reporting his death. The Court found the medical evidence proffered at appeal was not fresh evidence and therefore rejected it. The Court qualified the ruling in *Cannings* regarding conflicting expert opinion:

> *In cases like the present, if the outcome of the trial depends exclusively or almost exclusively on a serious disagreement between distinguished and reputable experts, it will often be unwise, and therefore unsafe, to proceed.*[195]

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[194] Ibid n 8, *Kai-Whitewind*, 85.
[195] Ibid n 5, *Cannings*, 178.

The Court held that if *Cannings* was read to mean disagreements between reputable experts neutralised Crown expert evidence, the prosecution would have to provide evidence independent of medical evidence, a proposition which the Court did not endorse. It held the jury must be allowed to choose between conflicting expert opinions as to the cause of disagreement or the conclusions that can be drawn from it.

The Court held that there were several important differences between *Cannings* and *Kai-Whitewind*. The medical evidence itself was more extensive. There was other evidence suggesting guilt: that is, the mother had difficulties bonding with the infant, had spoken (albeit fleetingly) of killing him, may have delayed reporting his death; and there was a single, rather than serial, death. In Kai-Whitewind the original post-mortem concluded that mechanism of death was 'unascertained' and that natural causes could not be ruled out. A second and third post-mortem inquiry was conducted. The defence trial experts maintained their view that, having reviewed the later post-mortems, the mechanical cause of death was unascertained.[196] The *Kai-Whitewind* judgment indicates that *Cannings* does not provide authority for other SUDI trials. The difficulty lies in reliably determining what constitutes 'other cogent evidence'. The inculpatory meaning and reliability of non-medical evidence, as indicators of guilt, is questionable and was not resolved in *Kai-Whitewind.*

3.1.5 Analysis and conclusions

Each of the English convictions that were quashed highlights the persuasive power of medical opinion evidence to force an uncertain and equivocal set of post-mortem findings into certainty at trial, with beliefs about the unlikelihood that recurrent death is

[196] Ibid n 8, *Kai-Whitewind*, 57, 66.

a coincidence and describing a case being 'typical' of smothering when there is limited reliable evidence about post-mortem findings in smothering cases. The idea that there are typical or predictable manifestations of smothering does not have a theoretical or empirical foundation and ignores the difficulty that physicians in research and clinical practice have in reliably identifying smothering deaths. Apart from the many new medical conditions that are identified every year, there are many that are as yet unknown but may explain multiple SUDI. Furthermore, in these cases, courts have admitted speculative circumstantial evidence, based on psychosocial or other non-medical factors, such as the mother's presence at the deceased infant's bedside, as inculpatory evidence. Since the presence of mothers near their children is ubiquitous, it is an insignificant fact until it is combined with equivocal medical opinion on the meaning of recurrent SUDI – based on questionable medical reasoning in the first place - to render it suspicious. Current medical literature does not support definitive conclusions to be drawn in the absence of medical evidence strongly suggesting the manner of death was homicide: at most, experts ought to say the mechanism of death is unknown or undetermined. The appeals suggest the need to assess expert evidence carefully before admission to trial and greater efforts being made to determine its reliability. Otherwise, exaggerated, biased and mistaken medical testimony will continue to be admitted to SUDI trials and undoubtedly wrongful convictions will remain a real threat.

Arguably, given that medical opinion evidence has a subjective element, the fact that experts disagree is a reality that courts have to manage, and not necessarily by dismissing or marginalising minority expert opinion. In Anthony's case, the issue of resolving conflicting expert opinion was immaterial, as the experts whose views the Court endorsed were favourable to her application. The Court was itself considerably assisted by new medical evidence of a genetic propensity for SIDS deaths in generations

of Anthony's family. Without the new medical evidence it is likely that the court would have had difficulty determining the reliability of conflicting medical opinion, even if the rules of evidence required appellate courts to do so. Imposing reliability standards at the pre-trial stage would help to prevent miscarriages of justice.

The *Kai-Whitewind* judgment established that the concerns expressed in *Cannings* about expert disagreement do not apply if there is other inculpatory evidence. However, the emphasis by the Court on other evidence in *Kai-Whitewind,* much of it of a psychosocial or non-medical nature, is disconcerting because the reliability of these factors in identifying inculpatory behaviour is unknown. There is a real risk that psychosocial factors are attributed greater weight than is justified. Psychosocial factors were central to Clark being found guilty. Yet, she was wrongly convicted. The combination of psychosocial factors and medical opinion evidence of unknown reliability has contributed to miscarriages of justice in *Clark, Cannings*, and *Anthony.* Moreover, we cannot be confident about the conviction of *Kai-Whitewind*.

3.2 Australia

The Australian cases involving medical opinion evidence in recurrent SUDI are relevant to the discussion about criminal trials for infant deaths. These cases establish that the problems associated with medical opinion evidence in the successful appeals in the United Kingdom are not a local problem, nor a problem specific to any one medical expert or jurisdiction or court.

3.2.1 Tracey Phillips

On 27 August 1996, Tracey Phillips[197] was charged with the murder of her son, Benjamin, aged 8 months and pleaded not guilty. The Crown applied to adduce evidence of the deaths of two other children, Natalie and Nathan, and ALTEs[198] in several of the children. The basis for admission was ss 97 and 98 of the Evidence Act 1995 (NSW) regulating the admission of tendency and coincidence evidence.

Phillips found Benjamin in his cot with blue lips. Benjamin died in hospital after resuscitation attempts failed. At the post-mortem examination, all investigations, including for trauma, accidental or non-accidental, and genetic and metabolic disorders were negative. Cause of death was assigned to either SIDS or induced asphyxia. The post-mortem findings did not confirm or exclude either condition.

Benjamin had previously experienced an ALTE at 2½ months. He was Phillips' fifth child with her de facto partner. The eldest had no significant medical history. Nathan died at 2½ years in December 1993 with the medical cause of death assigned to aspiration pneumonia. Natalie, born in 1992, was admitted to hospital on five occasions for ALTEs and died in August 1993, aged 9 months. The death was classified as SIDS. Jack was born in 1994 and was admitted in hospital for an ALTE in 1995. The Crown applied for admission of the facts relating to Benjamin's siblings' ALTEs and deaths as evidence of 'related events' that prove, due to the improbability of these events occurring coincidentally, that Benjamin's death was due to induced asphyxia.[199] Alternatively, the Crown submitted the evidence relating to Benjamin's siblings is admissible as evidence of 'tendency' to 'conduct herself in a way detrimental to the well-being of her children

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[197] Ibid n 9, *Phillips*.
[198] Apparent or acute life threatening events consisting of temporary cessation of breathing.
[199] Ibid n 9, *Phillips*, 12.

and to cause breathing difficulties and attendance at hospital'.[200] The Crown also submitted the evidence was admissible as 'relationship evidence' or similar facts evidence.[201]

The similar facts the Crown sought to rely on were that each of the deceased were: Phillips' natural children; located in a state of not breathing or experiencing difficulty breathing by Phillips and taken to hospital by Phillips; and Phillips' partner was unavailable due to domestic problems. The Court heard evidence from several medical experts, some conflicting, about the ALTEs and cause of death of Nathan and Natalie. Experts were willing to state that the deaths were suspicious but they did not positively confirm the deaths were due to asphyxia.[202] Bell J found that the circumstances of Nathan and Natalie's deaths did not support the notion that Benjamin's death was due to induced asphyxia. The Crown's application for admission of the siblings' deaths and ALTEs was rejected, as it did not meet the requirements for relationship, tendency or coincidence reasoning. The Crown did not pursue the case.

3.2.2 Kathleen Folbigg

Kathleen Folbigg's four children died over a 10 year period: Caleb, aged 19 days died in 1989; Patrick, aged 8 months in 1991; Sarah, aged 10½ months in 1993; and Laura, aged 19 months in 1999. In 2003, she was convicted on the charge of manslaughter for Caleb's death, murder for the other three children, and malicious infliction of grievous bodily harm with intent for Patrick who had suffered an ALTE. She was sentenced to a total imprisonment term of 40 years and a non-parole period of 30 years.[203] In February

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[200] Ibid n 9, *Phillips*, 12.
[201] Ibid n 9, *Phillips*, 12.
[202] Ibid n 9, *Phillips*, 80.
[203] Ibid n 9, *Folbigg*.

2005, the NSW Court of Criminal Appeal dismissed an appeal against the convictions, but reduced the length of the sentence to 30 years with a non-parole period of 25 years, on the basis that the original sentence was too severe and discouraged rehabilitation.[204]

The prosecution case consisted of contested medical opinion evidence,[205] interpretations of psychosocial (behavioural) factors as inculpatory and the allegedly confessional diary entries Folbigg made about the infants' deaths. At the time of each deceased infant's autopsy, the mechanical cause and manner of death was attributed to SIDS, uncertain or undetermined causes, or a physical cause (for example, myocarditis was noted as a possibility in Laura's case after a primary finding of undetermined). The trial judge allowed the Crown to tender evidence, on the basis of coincidence reasoning, that similarity between the infants' deaths was evidence that the deaths were correlated and caused by the same mechanism: deliberate smothering. The Crown conceded that the evidence of each death in isolation was insufficient to establish a connection between the four deaths, hence the need to try the deaths together. In the trial, 19 medical experts were either examined or proffered written testimony.[206] Prosecution medical experts testified that recurrent SUDI raises suspicion that all deaths were inflicted, relying on a similar argument to that asserted by Meadow in *Clark* and *Cannings*.

Central to the prosecution case was the rarity in the medical literature of recurrent SUDI, especially four deaths. This issue alone appears to have been given great weight as evidence of culpability and homicide. The Crown led the case as if medical consensus existed about cause of each death, yet, at the time of each death, there were

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[204] *R v KF* (2005) 152 A Crim R, [2005] NSWCCA 23.
[205] Ibid n 15, 196-202; Betts, S, and Goodman-Delahunty, J, 'The case of Kathleen Folbigg: how did justice and medicine fare?' (2007) 39 *Australian Journal of Forensic Sciences* 11-24.
[206] Ibid n 15, 72.

inconclusive autopsy results, with SIDS or upper airways obstruction of some form deemed probable. Expert disagreement continued throughout the trial. Professor Byard noted in his evidence that the post-mortems were not carried out in exactly the same manner for each child. Variations in conducting autopsies means that the results may not have been comparable and identifying a single mechanism of death for all four children on the basis of non-standardised investigation is a further source of unreliability.

The defence argued the prosecution case was weak and circumstantial; there was no consensus among medical experts about the cause of each child's death; and Folbigg had taken care of her children's physical and medical needs. There was no direct evidence that Folbigg had killed or harmed her children, and both Folbigg and her husband denied killing their children. Folbigg maintained her innocence throughout the pre-trial submissions, trial, and subsequent appeals.

Folbigg is unusual in that it was the subject of a scholarly publication by Cunliffe that examined the many stages of the case, from pre-trial appeals, the trial and subsequent appeals.[207] The exposition documents the vast medical-scientific evidence proffered in the case and the admission of unfairly prejudicial reasoning, such as Meadow's Law,[208] at a time when it was known that Meadow's flawed opinion was an important element in Clark's successful appeal. Despite the trial judge expressly prohibiting medical experts from considering the meaning of all four deaths together, the case reveals a shift in medical opinion about cause of each infant's death considered in isolation (after each autopsy) from possible natural causes to likely homicide during the trial, based seemingly on the fact of recurrent SUDI.[209] Moreover, Cunliffe

[207] Ibid n 15.
[208] See Chapter 2 for medical discourse on smothering.
[209] Ibid n 15, 72-95.

concluded, the *Folbigg* trial and appeals courts were not proffered medical evidence, available at the time, indicating that SUDI recurrence can be due to natural causes.[210] Instead medical experts testified that such evidence did not exist or that which existed was unreliable. Only two experts, Professor Byard and Dr Seton, informed the court that it is *possible* that SIDS can recur. All the medical experts, including Professor Byard, agreed that they had not previously encountered a case of four children dying suddenly at home in their sleep. There was a history in the paternal family of obstructive sleep apnoea.

Folbigg reveals some core problems with medical opinion evidence in SUDI trials. Firstly, the evidence of 19 reputable medical experts who testified, each espousing different views on various medical issues, challenges the notion there is one 'correct' answer regarding the cause of SUDIs. Determining the mechanism of death is an inferential process in which there are differences of opinion, rather than absolute facts, which ought to be reflected in expert testimony. For example, experts disagreed as to whether myocarditis explained Laura's death and whether viral infection detected at autopsy might account for the myocarditis. Secondly, there was a shift in medical opinion on the mechanism of death between the original post-mortem results on each infant and testimony provided at trial. Crown expert, pathologist Dr Alan Cala, who conducted Laura's autopsy, concluded her death was undetermined, acknowledging a potential natural cause. During the trial, however, despite being prohibited from considering the four deaths together, Cala testified myocarditis was not a possible mechanism preceding death.[211] Lastly, defence rebuttal experts, ostensibly a trial

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[210] Ibid n 15, 195.
[211] Ibid n 15, 202.

safeguard, failed to alter the overwhelming, though misleading, prosecution medical testimony. One defence rebuttal expert, cardiologist Dr Owen Jones, was the main proponent of myocarditis as an explanation. Jones exercised greater caution than did prosecution experts, and some defence experts, and informed the court about the uncertainty inherent in SUDI autopsies.

The prosecution also based its case on non-medical evidence, including Folbigg's personal diary entries and behavioural or psychosocial inculpatory factors. Folbigg was depicted as a mother who had violated social expectations of motherhood, and was, hence, *capable* of murdering her four infants. Cunliffe concluded the prosecution relied on the diaries to incorrectly suggest the entries contained a direct confession, and substituted interpretation of the entries for reliance on the text itself. [212] Such an interpretation conforms to the prosecution narrative, but not to Folbigg's own account of the meaning of her diary entries, which she denies was an admission of guilt. Further, Cunliffe has criticised the alleged behavioural indicators of guilt, such as Folbigg finding the infants after death while their bodies were still warm, upon which the prosecution relied, describing this evidence as deriving from common sense and lacking an empirical basis.[213] She concludes that the reliance on the ambiguous diary entries lent the appearance of cogency to the equivocal and uncertain medical and behavioural evidence.[214] Cunliffe agreed with the judgments in *Phillips*, *Clark* and *Anthony,* observing that it is 'inappropriate to rely on ambiguous evidence to supplement inadequate scientific knowledge'.[215]

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[212] Ibid n 15, 134-156.
[213] Ibid n 15, 133.
[214] See generally Ibid n 15, Cunliffe, 'Reading guilt: Kathleen Folbigg's diaries' 134-156.
[215] Ibid n 15, 195.

3.2.3 Carole Matthey

Carole Matthey was presented for trial[216] for the murder of four of her five children, Jacob, Chloe, Joshua and Shania. The prosecution alleged that each death was due to deliberate suffocation and sought to adduce post-mortem findings consistent with suffocation. The Crown also sought to adduce circumstantial evidence that Matthey committed acts, including the murders, to sustain her relationship with her husband.

The infants died across four years. Jacob died on 8 December 1998, aged 7 months. Paediatric pathologist, Dr Peter Campbell, attributed the death to SIDS. Jacob was undergoing extensive medical examination for a potential metabolic disorder when he died. Dylan, born on 27 May 1997, survived an ALTE six weeks before Jacob died. Matthey told ambulance officers that she had found Dylan, listless, purple in colour and experiencing breathing problems. Chloe died on 27 November 2000, aged 10 weeks. Matthey said she had found Chloe in her cot, not breathing after being put down for her afternoon sleep. Dr Campbell again conducted the autopsy and classified the death as SIDS. He also noted that a second SIDS death raises the possibility of an inherited genetic condition and non-accidental injury. Metabolic tests were negative for both Jacob and Chloe. He concluded there was no evidence of non-accidental injury and noted that other, as yet unknown, metabolic disorders could not be diagnosed.

Joshua died on 10 July 2012, aged 3 months, after being born six weeks prematurely. He remained in hospital for two weeks because he had neonatal respiratory distress syndrome. A sleep apnoea monitor was provided due to the previous deaths. Joshua underwent surgery for pyloric stenosis but experienced a cardiac arrest in intensive care, where he was intubated and on ventilation for five days. There was no

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[216] Ibid n 9, *Matthey*.

evidence that Matthey was involved with the incident. Joshua remained relatively well after discharge. He was prescribed antibiotics for an ear infection, secondary to respiratory tract infection on the day before he died. On 10 July 2012, Joshua was found limp and not breathing in his pram after a shopping trip with Matthey and the other siblings. Paramedics failed to revive him. The post-mortem examination found evidence of Klebsiella septicaemia, which was recorded as the mechanical cause of death.

Shania died on 9 April 2003, aged 3 years, 5 months. She was relatively well, except for two episodes in which she held her breath when crying. Shania experienced two episodes of apnoea on the day before she died. She was well by the evening and was given a bottle twice in the night, once by her father. The following morning, Matthey discovered Shania not breathing and without a carotid pulse. The post-mortem concluded the mechanism of death as unascertained. Further extensive investigations were unable to identify known diseases. The examining pathologist stated the 'examination of autopsy records provided no evidence of significant or recent prior injuries that suggest any form of direct physical abuse and there was no anatomical evidence of significant accidental injury'.[217]

The Crown challenged the pathological evidence by calling other experts. Dr Susan Beal accepted Jacob's death might have been SIDS, if thoroughly investigated, which she said it was not. In the subsequent deaths, she proposed that filicide was the most likely, though unproven cause. Interestingly, she attributed Joshua's respiratory arrest in intensive care to Matthey. Beal concluded 'all the evidence points to all the children having been killed by non-accidental suffocation',[218] based on her belief that

[217] Ibid n 9, *Matthey*, 55.
[218] Ibid n 9 , *Matthey*, 63.

Shania died of non-accidental suffocation and 'reasoned backwards to a probability that the other three children died by non-accidental suffocation'.[219]

Dr Allan Cala, a pathologist, queried the findings of each autopsy. He believed 'unexplained' was a better classification than SIDS for Jacob's death. Cala dismissed Campbell's exclusion of non-accidental injury in Chloe by including the fact of Jacob's death and unexplained ALTE. He found Chloe's death 'undetermined'. In reference to Joshua's cardiac arrest after surgery, Coldrey J noted that Cala, like Beal, 'implies, despite a total lack of evidence, that Mrs Matthey may have had a part to play in this event'.[220] Cala found Shania to have been smothered. He observed:

> *I cannot say with absolute certainty that it is impossible that some as yet undiagnosed metabolic or inherited condition caused the deaths of these children, however I believe there does not exist such a condition. I believe however that that particular possibility remains so highly unlikely as to be virtually impossible, given the investigations that have been performed to date.*[221]

Despite concessions about his conclusions in cross-examination, Cala maintained his view that each death was consistent with smothering.

Similarly, Dr Janice Ophoven, a paediatric forensic pathologist, provided testimony disagreeing with the original pathologists' opinions, advancing 'homicidal suffocation'[222] as the cause of each death, especially by relying on non-medical facts, such as the 'fact that Chloe was in the care of her mother before she died; that there was an unexplained and unexpected death in more than one sibling; and that the previous death had occurred in the presence of the same person (Mrs Matthey)'.[223]

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[219] Ibid n 9, *Matthey*, 69.
[220] Ibid n 9, *Matthey*, 75.
[221] Ibid n 9, *Matthey*, 85.
[222] Ibid n 9, *Matthey*, 106.
[223] Ibid n 9, *Matthey*, 105.

Ophoven placed considerable emphasis on pulmonary haemorrhages in Jacob, Joshua and Shania, relying on this finding as further evidence of homicidal suffocation.

In August 2004, the Director of Public Prosecutions asked Professor Stephen Cordner, a Professor of Forensic Medicine at Monash University and Director of the Victorian Institute of Forensic Medicine, to provide his opinion on the four deaths. Cordner found that each of the findings were 'compatible with natural causes of death and indicated that there was no point of major disagreement between him and the three pathologists involved'.[224] In examining Dr Ophoven's report, he observed:

> *...forensic pathologists do not get into a consideration of circumstances of a psycho-social kind (e.g. the fact 'that one or more of the children might have been the result of an unwanted pregnancy') or that might indicate potential suspicion (that Ms Matthey was the last person to see the children alive) where those circumstances are unrelated to the autopsy findings or medical history. I believe that we are not necessarily equipped or trained to do that, and public prosecutors in courts are. In addition, they are probably not matters of expertise, and if that is so, pathologists are no better able to evaluate them than anyone else.*[225]

Cordner also stated that the emphasis placed on pulmonary haemorrhaging and use of this finding to support intentional suffocation was unjustified as it is a 'very non-specific finding common in deaths from many causes'.[226] He cited Professor Berry, Professor of Paediatric Pathology, 'Pulmonary haemorrhage…is neither a necessary nor specific marker of deliberate or accidental suffocation'.[227] More significantly, the absence of teeth marks on the inside of Shania's lips was seen as an important finding, as suffocating a child aged 3 years and 5 months would leave marks. Cordner found

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[224] Ibid n 9, *Matthey*, 119.
[225] Ibid n 9, *Matthey*, 121.
[226] Ibid n 9, *Matthey*, 125.
[227] Ibid n 9, *Matthey*, 125.

significant that Joshua suffered a cardiac arrest requiring 60 hours of ventilation, suggesting, 'questions about Joshua's sensitivity to circumstances tending to suppress respiration such as might occur in SIDS'.[228] Cordner supports the view of Dr Pollanen – Chief Forensic Pathologist in Ontario since 2006 – who stated:

> *Pathologists are faced with the task of detecting concealed homicides, particularly of infants, children and young women. In these cases the post-mortem findings are often minimal or non-specific, and a pathologist may be tempted to over-interpret findings based on suspicious circumstances. Thus, in the past, some pathologists may have given a conclusion of 'asphyxia', 'smothering', or 'suffocation' based on non-specific findings and suspicion, or even a reported confession. Proponents of giving a definitive cause of death in these situations often argue that this is an example of diagnosis by exclusion; when all reasonable natural processes are excluded, then asphyxia is a reasonable alternative. However, in these cases the autopsy evidence is more supportive of rendering a decision of unascertained.*[229]

Coldrey J disagreed with the Crown's contention that when considering the mechanism of death for any one infant, the medical evidence in relation to the other children is relevant.[230] Coldrey J endorsed the approach in *Cannings* that 'the rarity of the phenomenon of four unexpected and seemingly unexplained deaths in one family cannot, of itself, provide a cause of death'.[231] Coldrey J distinguished between the role of the jury and the inferences it could make from the entirety of evidence before it and that of the medical expert with regard to coincidence reasoning as a basis for assigning the mechanism of death. Coldrey J also rejected the reliance by some experts on non-medical or psychosocial factors, such as Matthey being present when the infant died,

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[228] Ibid n 9, *Matthey*, 134.
[229] Ibid n 9, *Matthey*, 136.
[230] Ibid n 9, *Matthey*, 187.
[231] Ibid n 9, *Matthey*, 191.

as this is not unusual and does not provide probative weight in determining the mechanism of death. Coldrey J strongly criticised medical experts' reliance on non-medical factors in forming opinions on the mechanism of death.

> *In this case (as in Folbigg) the determination of the actual cause of death is a matter for the jury and the medical evidence must be limited to opinions of the diagnostic possibility of, or consistency with, an asphyxial episode.*[232]

Coldrey J excluded significant portions of psychosocial evidence sought to be adduced by the Crown, such as Matthey's relationship with her husband, her behaviour towards her children, as either incorrect, irrelevant or unfairly prejudicial. The Crown dropped its case as large tracts of evidence, both medical and psychosocial, were excluded.

3.3 Canada

In 2005, the Chief Coroner of Ontario reviewed 45 cases in which the region's chief pathologist, Dr Charles Smith, had testified on the cause of a child's death. There had been increasing concerns in the region about Smith's performance, culminating in the discovery that William Mullins-Johnson had been wrongly convicted for first-degree murder of his 4-year-old niece, Valin. The prosecution relied on Smith's post-mortem findings that Mullins-Johnson had sexually assaulted and strangled Valin. Mullins-Johnson served 12 years before being acquitted in 2005, after an independent panel of experts concluded Valin had died of natural causes.

Following the Chief Coroner's review of Smith's cases, the Ontario government set up a judicial inquiry into paediatric forensic pathology conducted by

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[232] Ibid n 9, *Matthey*, 184.

Goudge J.[233] This inquiry conducted a comprehensive review of medical and legal aspects of SUDI investigation and provided guidance to appellate courts hearing cases in which Smith gave evidence of cause of death. The Inquiry accepted wide-ranging opinion on current medical research and clinical knowledge in SUDI investigation. The Inquiry was able to provide a comprehensive analysis of SUDI, and its problems, thereby assisting subsequent appellate hearings. In this sense, the Canadian appeals had the benefit of evidence lacking in lower courts and in the UK appellate cases. To date, two cases have come before appellate courts.

3.3.1 R v Sherry Sherret-Robinson[234]

On 23 January 1996, Sherry found her 4 month old son, Joshua, not breathing in bed. She was subsequently charged with first-degree murder and her remaining son, Austin, was removed from her care and was later adopted by his foster parents. Smith conducted the autopsy and testified that Joshua died of asphyxia, resulting from suffocation or smothering by a third party. Smith also testified there was other evidence of homicide, namely Joshua had a skull fracture, neck trauma and a healing fracture of the left ankle. Before trial, the Crown withdrew the murder charge and laid a charge of infanticide. Sherret-Robinson consistently denied killing Joshua. She agreed not to contest certain facts, including that she smothered Joshua, and pled not guilty to the infanticide charge. On 4 January 1999, Sherret-Robinson was convicted of infanticide and was sentenced to one year in prison.

During his review of Smith's cases, Dr Michael Pollanen, Chief Forensic Pathologist for Ontario, examined Smith's investigation of Joshua's death. He found

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[233] Ibid n 13, Goudge; See Chapter 8, sub-section 8.3.2 for a more detailed discussion of the Goudge Inquiry.
[234] Ibid n 10, *Sherret-Robinson*.

Smith's conclusions were inaccurate and unsubstantiated by medical evidence. Experts who further examined the medical evidence for the appeal agreed on the following: the apparent skull fracture was a developing cranial suture (line of junction between two bones); the neck haemorrhages were dissection-related artefacts from the autopsy; the left ankle injury may have been caused by deliberate or accidental mechanisms; the petechial haemorrhages and lung congestion Smith attributed to inflicted injury were in fact common findings in infant deaths and not diagnostic of homicide; there was no evidence of brain swelling; there was no positive evidence supporting suffocation or smothering. As Joshua was sleeping in a playpen containing blankets and quilts, the autopsy and death scene findings suggested that death occurred by accidental asphyxiation mechanisms within an unsafe sleeping environment.

In the appeal, the Crown consented to the admission of the fresh evidence and acquitted Sherret-Robinson. The submissions to the appeal indicated that the police, the Crown and the defence relied on Smith's expert opinion and, at the time, Smith was held in high regard. Sherret-Robinson and her counsel did not believe they could successfully challenge Smith's opinion. The Crown accepted that the new expert opinion conclusively refuted significant aspects of Smith's opinion, thereby challenging the safety of the conviction. Sherret-Robinson was acquitted.

3.3.2 R v Tammy Marquardt [235]

On 24 October 1995, Tammy Marquardt was convicted of second-degree murder of her son, Kenneth, aged 2½ years. Kenneth had several health issues including asthma, pneumonia and seizures. On several occasions, Marquardt had taken Kenneth to hospital

[235] Ibid n 10, *Marquardt*.

for treatment of seizures and he was prescribed Dilantin to control the seizures. The defence position at trial was that Kenneth had died accidentally during a seizure.

Social workers had assisted Marquardt during her pregnancy and after birth. She expressed her difficulty in soothing Kenneth, having several blackouts, and imagining putting her hands around the baby's neck and stifling his crying by placing her hand over his mouth. At her trial, Marquardt testified that she was expressing fears that she might unintentionally mishandle Kenneth due to her own exhaustion. In early 1993, Kenneth was placed in a foster home at Marquardt's request, as she was worried she might hurt him. Marquardt also took refuge from her husband's abusive behaviour. She told a supervisor that she had squeezed Kenneth's leg and had caused a bruise.

On 9 October 1993, Marquardt found Kenneth rolled up in his bedding and calling out to her. By the time she was able to extricate Kenneth from the bedding he was white and seemed not to be breathing. She called emergency services but was too distraught to follow their cardio-pulmonary resuscitation (CPR) instructions. There was evidence that, while having drinks with friends, Marquardt had blamed herself for killing Kenneth because she was unsuccessful in administering CPR. However, other friends testified that Marquardt said she had killed Kenneth, rather than expressing guilt that she had been unable to carry out CPR. Kenneth was on a life support system at hospital until he died three days later. The child protection team became involved because the treating physician was unconvinced that Marquardt's explanation was consistent with the observed signs. Kenneth's liver, kidneys and heart valves were harvested for organ donation.

Smith conducted the autopsy, unperturbed by the missing organs. He concluded that medical cause of death was 'asphyxia' leading to irreversible brain damage. Smith based his opinion on petechial haemorrhages on organ surfaces and the small skeletal

muscles of the neck, and brain swelling. Smith testified that a natural disease did not cause the asphyxia that led to Kenneth's death[236] nor did a seizure, as seizures do not lead to asphyxia. He conceded that he was not an expert on sudden and unexpected death in epilepsy (SUDEP). Kenneth's paediatric neurologist testified that SUDEP did not apply in his case. Physicians also testified that Kenneth's seizures were primarily of febrile origin, not epilepsy.

Marquardt appealed unsuccessfully in 1998. However, in 2009, during the reinvestigation of Dr Charles Smith's cases, Marquardt was granted leave to Appeal to the Supreme Court of Canada. On 30 April 2009, the Supreme Court of Canada remanded the case to the Court of Appeal for Ontario for consideration of fresh evidence and whether the conviction constituted a miscarriage of justice. The Crown agreed the fresh evidence be admitted, the appeal allowed and a new trial ordered.

Fresh evidence presented at appeal consisted of opinion from Professor Saukko – who also testified at the Goudge Inquiry – that there was insufficient evidence to diagnose asphyxia and petechial haemorrhages were not specific to suffocation. Saukko concluded the death should have been categorised as 'unascertained'. In addition, Crown forensic pathologists concurred with Marquardt's argument that Smith had made significant mistakes. The mechanism of death should have been 'unascertained' and SUDEP could not be excluded. The Crown further recommended that paediatric neurologists assess the possibility of the death being SUDEP. Crown neurologists agreed that SUDEP was a possible explanation for the death. After analysing Kenneth's medical records, the neurologists concluded his seizures were consistent with epilepsy and not of febrile origin.

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[236] Ibid n 10, *Marquardt*, 8.

The Court accepted the fresh medical evidence and concluded Smith had made several mistakes. Firstly, the petechial haemorrhages were not diagnostic of intentional suffocation. The mechanism of death should be undetermined or unascertained. Secondly, Smith's testimony and use of the term 'asphyxia' was confusing and misleading. The Court quoted the Goudge Inquiry findings that Smith used the word 'asphyxia' inconsistently, at times as mechanical asphyxia or imposed airways obstruction and at other times as its benign definition of the cessation of breathing.[237] His testimony was generally confusing and difficult to comprehend, and in Marquardt's case, was unscientific:

> *...inappropriate expressions are found throughout his testimony. The language of "betting" is one of them. In Kenneth's case, Dr Smith testified that suffocation can occur without leaving any marks and that, if he were a "betting man", he would say that suffocation was a better explanation for Kenneth's death than manual or ligature strangulation.*[238]

Lastly, the Court held Smith erred by concluding that the autopsy excluded the possibility of SUDEP. The Court ruled the Crown neurologists' opinion favouring SUDEP as the mechanism of death met the test for fresh evidence. This and other evidence adduced at the appeal would have raised reasonable doubt about whether Marquardt had caused Kenneth's death. Consequently, a jury could therefore find there was reasonable doubt about the mechanism of death. However, Marquardt's comments before and after Kenneth's death and her description of events preceding death may be inconsistent with SUDEP. The Court concluded the conviction constituted a miscarriage

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[237] Ibid n 13, Goudge, 408-409.
[238] Ibid n 13, Goudge, 188.

of justice. It allowed the appeal, set aside the conviction for murder and ordered a new trial.

3.4 Conclusions

In each of the cases of recurrent SUDI discussed, alone, none of the infant deaths was originally thought to be suspicious by the examining pathologist. At most, the mechanism of death was undetermined, meaning that medical investigations did not provide an explanation. Arguably, taken together, more than one death was also not necessarily suspicious. The experts at each trial knew that there was more than one death, which might account for the transition in medical opinion from the possibility of a natural or undetermined mechanism of death to deliberate smothering. Cunliffe identified the shifting opinion on cause of death in *Folbigg*, an observation that can equally be made in *Clark*, *Cannings* and *Anthony,* all of which were cases of multiple SUDI. This suggests the problem is not localised and reveals medical reasoning that is unsupported by the empirical literature. There was already discussion of the inculpatory meaning of recurrent SUDI in the medical literature but there was no independently corroborated proof that multiple deaths were proof of homicide.[239] Arguably, the admission of multiple deaths, on the basis of coincidence reasoning, enabled what was ultimately speculative medical opinion to influence the trials. A view that recurrent SUDI constitutes homicide does not entertain the real possibility that separate, non-inflicted mechanisms were involved (such as subtle breathing or airway or apnoea issues, premature birth, myocarditis). Inevitably, questions of bias towards guilt arose in these cases. The errors in these cases, therefore, are a medico-legal problem, rather than being

[239] Ibid, n 122; See Ibid, n 15, 194, Cunliffe's conclusion that experts in *Folbigg* – both defence and prosecution – who proffered opinion that the medical literature had not reported the death of three or more infants from natural unexplained causes was incorrect.

failures specific to either discipline or to any particular medical expert, court or jurisdiction. A crucial medical and legal issue is whether the several deaths should have been considered together at all, given that multiple deaths were documented in the literature. The admission of the fact of previous deaths inevitably raised the question that the deaths were suspicious, despite the absence of any compelling medical or legal reason to support this view. Under these circumstances it is more accurate to conclude that the mechanism of death is unknown or cannot be identified on the basis of available evidence.

In Australia, there have been three notable criminal cases of recurrent SUDI, two of which did not proceed to trial. The first case, that of Louise Phillips, took place well before the successful appeals in the UK. In *Phillips*,[240] the judge did not admit evidence of deaths and ALTEs in other siblings of the deceased infant whose death was the subject of criminal proceedings against his mother. The second case, that of Kathleen Folbigg, was being tried as Clark's conviction was quashed. Cannings was released before Folbigg's appeal was heard, and Anthony was released after this. Folbigg was convicted and sentenced to 25 years of imprisonment. This case was the subject of research published by Cunliffe, a legal scholar who concluded that the case constitutes a wrongful conviction. Cunliffe found that the facts in *Folbigg* were similar to *Cannings*, that is, there was limited medical evidence of homicide, yet the *Cannings* judgment did not influence the trial and appeals in Folbigg's case.[241] Cunliffe concluded medical experts in *Folbigg* were 'vulnerable to the same criticism as was made of Meadow in *Cannings* and *Clark*'.[242] The *Folbigg* courts did not address the issue of conflicting

[240] Ibid n 9, *Phillips*.
[241] Ibid n 15, 94.
[242] Ibid n 15, 94.

medical opinion testimony, despite the benefit of the judgment in *Cannings*. The third case is that of Carole Matthey, whose trial did not proceed after the trial judge excluded substantial portions of the medical and psychosocial opinion evidence tendered by the Crown. In *Matthey*, the medical evidence of Drs Cala, Beal, and Ophoven, was rejected, whereas in *Folbigg* these experts' similarly unreliable testimony was admitted. Ophoven, Cala and Beal's evidence in *Matthey* were examples of the extent to which non-medical facts were held as inculpatory, with no empirical/research or clinical experience-based justification for their opinions. The willingness of the judges in *Phillips* and *Matthey* to exclude unreliable medical evidence that was based on coincidence reasoning stands in contrast to *Folbigg.* The exclusion of medical opinion evidence is justified given the ongoing and unresolved debates in medicine about accurately determining the mechanism of death in recurrent SUDI.

The approach taken by Coldrey J and Professor Cordner in *Matthey* exemplifies the way in which cases of SUDI, especially recurrent SUDI, ought to proceed. That is, medical experts were expected to remain within their expertise and any reliance on non-medical or psychosocial evidence was not tolerated. Coldrey J's review of psychosocial factors essentially led to evidence that was unfairly prejudicial being excluded. The judge's logical review of evidence was matched by Cordner's testimony which clarified for the court the role a pathologist can play in death investigation, as well as pointing out the many limitations of medical knowledge about why some infants die suddenly. The medico-legal approach in *Matthey* serves as a potential model of medical and legal evidence management in SUDI cases. Most

significantly, Coldrey J did not leave conflicting expert opinion for the jury to resolve. Rather, his response to the proposed Crown evidence involved a critical analysis of psychosocial or non-medical evidence that is often cumulative with medical evidence and represented as independent corroboration of homicide.

Matthey highlights a fundamental difference between pathologists, such as Cordner, who limit their opinion to their expertise, and paediatricians who believe that recurrent SUDI constitutes homicide. The former base their opinion on the mechanism of death on physical or medical evidence. The latter relies almost exclusively on ambiguous results refracted through psychosocial information, however inaccurate that evidence may be. Psychosocial factors (e.g. presence at the deceased's bedside, relationship problems, financial stress or unemployment) are often ubiquitous and their potential to discriminate between homicide and other causes of death is limited. Cordner sought to restore medical testimony back to the body, rather than relying on psychosocial facts, the implications of which are unclear.

In Clark, medical experts also relied on psychosocial factors as indicators of guilt. Similarly, in Anthony, the inconsistency of her responses was held as inculpatory evidence to prove she had murdered her children. In Anthony, this evidence was overlooked in light of Meadow's discredited medical evidence. The reliance on inconsistencies as proof of guilt is, like psychosocial factors, another aspect of determining the mechanism of death that is not supported by empirical research. Even in the case of Kai-Whitewind, whose appeal was dismissed on the grounds of cogent physical and psychosocial evidence beyond medical evidence, it is possible that the many concerning aspects of this mother's behaviour were not inculpatory. Rather, uncertain medical evidence was again shored up by psychosocial factors of uncertain meaning.

There is an inevitable confirmatory bias, typically unconscious, to interpreting signs of a case in a manner consistent with the expert's predominant views. In the situation of cases referred to child abuse experts, such as Meadow, their assessment is biased towards injecting inculpatory meaning into ambiguous or ubiquitous factors. An example being Meadow's diagnosis that Anthony suffered from Munchausen's Syndrome by Proxy, which was excluded by the trial judge. There is a significant risk that diagnostic errors will occur under these conditions. Similarly, the multiple deaths constitutes murder dogma which increased the likelihood that the deaths would be characterised as suspicious of murder, which shaped interest in and interpretation of psychosocial evidence and vice versa.

The successful appeals in England and Wales stemmed from efforts of the convicted women and their families, rather than any particular oversight by the trial judge or medical experts who testified in the trials. This is especially so in *Clark.* Cannings and Anthony benefitted from the review of Meadow's cases in the wake of Clark's successful second appeal. Consequently, the question of reliability of medical and other evidence in the *Anthony* appeal was relatively easily resolved by the appellate judges, rejecting evidence that multiple deaths constitute murder by reference to the review by the Criminal Cases Review Commission. The Commission criticised Meadow's evidence (and by association, that of other physicians who believe that multiple unexplained deaths means murder) and his failure to acknowledge the CONI study indicated that, though rare, SIDS or unexplained death can recur. The review resolved the question of whether recurrent SUDI constituted multiple homicides. Future criminal courts would also benefit from a balanced analysis of the current state of medical thinking about multiple SUDI.

Additionally, the credibility of experts such as Meadow was reduced by the findings of the *Clark* and *Cannings* appeals. Again, the question of reliability was determined at appellate level by reference to reputation and credibility. The Commission conducted the necessary analysis of the content of Meadow's opinion, facilitating the appellate review. The issue is not Meadow as an individual — as the tendency to overstate the certainty with which murder can be detected is evident in the testimony of many other experts, including Ophoven and Beal in Australia — rather, an expert's credibility should consist of more than their credentials or professional reputation: that is, the *content* of the expert's opinion should be the subject of critical analysis. Of significance is the basis of expert's opinion and whether it is reliable, according to what is known: published scientific knowledge. This review is essential if wrongful convictions and medico-legal errors are to be avoided in future multiple SUDI cases. A pre-trial joint statement from a panel of medical experts, delineating areas of agreement and disagreement and the application of this knowledge to the facts of the specific case is a solution to preventing future wrongful convictions.

The multiple SUDI successful appeals, convictions and pre-trial results (e.g. *Phillips, Matthey*) discussed in this chapter demonstrate that equally reputable medical experts can reach varying conclusions — based on their clinical experience — on the same evidence. Clinical judgment is susceptible to error and bias, even when proffered by experienced and highly qualified medical experts.[243] Two (or more) credible, reputable experts might disagree. Medical judgment consists of an interpretation of

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[243] Tversky, A, and Kahneman, D, 'Judgment under uncertainty' In: Arkes, H.R, and Hammond, K.R, (Eds) *Judgment and decision making: an interdisciplinary reader* (New York, Cambridge University Press, 1986) 38–55; Arkes, H.R, Wortmann, R.L, Saville, P.D, and Harkness, A.R, 'The hindsight bias among physicians weighing the likelihood of a diagnosis' (1981) 66 *Journal of Applied Psychology* 252–254. Unconscious processes are discussed in depth in Section III of the thesis.

medical facts and conclusions might be unique to each medical expert or to a group of experts. The subjective quality of medical opinion evidence renders estimates of reliability difficult to determine for trial judges, as well as juries, if such evidence is admitted. The legal and medical failures in the cases discussed indicate that the law and medicine ought to address evidentiary reliability to prevent future miscarriages of justice.

The Canadian experience played out similarly to the appeals in England with the initial concerns arising out of the testimony of a specific expert, Charles Smith. Flaws in Smith's work led to a judicial inquiry by Goudge J who made 169 recommendations, including monitoring the performance of paediatric forensic pathologists, and improving training and oversight of the discipline.[244]

The Canadian appeals, so far those relating to Sherret-Robinson whose conviction was quashed and Marquardt, whose case was ordered to be retried, stemmed from extensive reviews of Smith's opinion evidence in child death cases. Although these developments were limited to Ontario, there is no reason to believe that wrongful convictions are specific to a particular jurisdiction or medical expert or type of expert opinion evidence. The critical need is to conduct research to demonstrate, or refute, the opinions routinely proffered by medical experts in SUDI trials.

As in the English and Australian cases, psychosocial evidence that is ubiquitous (such as relationship distress) and does not identify whether a death constitutes homicide, is likely to acquire greater significance than is warranted, rendering both medical and psychosocial evidence as more inculpatory than it actually is. This is the problem when applying the appellate Courts' recommendation that 'other' evidence

[244] See Section Chapter 8, sub-section 8.3.2 for a detailed discussion of the Goudge Inquiry.

must be taken into account in medically ambiguous situations. For example, in *Marquardt,* the mother's comments before and after Kenneth's death and her description of events preceding death are effectively irrelevant if the classification of Kenneth's death as sudden unexpected death in epilepsy (SUDEP) is accurate.

A general observation about the English and Canadian appeals is that the way in which these errors were detected was not through any particular mechanism in law or medicine. Rather, certain medical specialists came to the notice of authorities due to persistent efforts by supporters of the wrongly convicted instead of through legal or medical efforts to oversee expert forensic conduct or assess the reliability of their testimony/opinion. This begs the question, how do we prevent wrongful convictions? Both the legal and medical communities need to develop mechanisms for assessing the reliability of medical opinion evidence. An advisory panel at pre-trial would assist the judiciary in decision-making across the course of the case in the courts. Such a report should also demonstrate how current knowledge applies to the specific case and issues in determining the mechanism of death, rather than being a general statement of knowledge in the field. Furthermore, admitted medical experts ought to make the basis of clinical opinion evidence transparent to the court, including limitations of their evidence.

Chapter 4: Shaken Baby Syndrome and the triad

> *If, 26 years after Caffey's description (of SBS), doctors are still undecided about the "shaken baby syndrome", the difficulties faced by experts in presenting medical evidence in court, and by judge and jury in making sense of it, are readily imaginable.* [245]

Shaken Baby Syndrome (SBS) refers to a cluster of brain and eye injuries found in infants who usually die as a result of the assumed trauma. It is hypothesised that shaking an infant violently causes the brain to accelerate and decelerate within the confines of the skull which causes shearing or tearing of bridging veins between the brain and skull leading to a triad of signs: (1) subdural haemorrhage or bleeding (SDH); (2) retinal haemorrhage (RH); and (3) diffuse axonal injury (DAI)/hypoxic-ischaemic encephalopathy (HIE - diffuse brain disease). The triad is accompanied by inappropriate or inconsistent history from the parent or carer that does not explain the observed injuries, is usually unwitnessed, and is commonly associated with other apparently inflicted injuries (e.g. skeletal fractures), although this is not a necessary sign.[246] The meaning of the triad and its causes is a particularly controversial subject in medicine and, when medical evidence about the triad is the basis for criminal prosecution for murder, it is equally so in the law. The triad represents a complex and perplexing cluster of fatal injuries that has polarised the medical community between physicians who believe the triad is a reliable indicator of fatal child abuse or homicide and those who do

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[245] Editorial (1998) *Lancet*.

[246] Guthkelch, A. N, 'Infantile subdural haematoma and its relationship to whiplash injury' (1971) 2(759) *British Medical Journal* 430-431; Kleinman, P, *Diagnostic imaging of child abuse (*New York, Mosby Year Book, 1998); Frasier, L, *Abusive head trauma in infants and children* (St Louis (MO), GW Medical Publishing, 2006); Kellogg, N, Committee on Child Abuse and Neglect, 'Evaluation of suspected child physical abuse' (2007) 119 *Pediatrics* 1232-41; Barnes, P, and Krasnokutsky, M, 'Imaging of the CNS in Suspected or Alleged NAI' (2007) 18 *Topics in Magnetic Resonance Imaging,* 53-74; Ibid n 49, Donohoe; Leestma, J. E, 'Case analysis of brain injured admittedly shaken infants, 54 cases 1969-2001' (2005) 26 *American Journal of Forensic & Medical Pathology* 199-212.

not agree that the evidence base of the triad is of sufficient specificity to make such absolute causal claims. The typical prosecution of SBS/triad cases has relied on the following premises: (1) shaking alone in an otherwise healthy child can cause brain haemorrhaging leading to death; (2) the triad cannot occur accidentally (e.g. from short-distance falls) as it requires a massive violent force equivalent to a motor vehicle accident or fall from a high-story building; (3) such injury immediately causes signs and cannot be followed by a lucid interval (as the force on the infant's brain is massive); and (4) new or recent injury signs (such as brain haemorrhage) in a child who has a history of previous head injury indicates newly inflicted injury and not a spontaneous re-bleed.[247]

At the outset, it is important to note that discussions of force and injury can be confusing and misleading.[248] The idea of 'massive' force being a prerequisite to developing the triad of signs conflates the consequences of brain injury (the massive head injury) with the forces required to cause the injury, which is not necessarily massive. Although the following discussion concentrates on SDH and RH, it is the DAI/hypoxic-ischaemic encephalopathy that typically results in clinical consequences and death. A relatively minor head injury can lead to unconsciousness. However, once unconscious, problems with the infant's breathing might ensue, as an unconscious person is unable to ensure their airway is clear. This can result in blockage of the airway with consequent reduction of oxygen in the blood leading to hypoxic brain damage. Clinically, this is sometimes called 'massive head injury'. Technically, the term 'injury'

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[247] Ibid, n 246, Kleinman; Ibid, n 246, Frasier; Ibid, n 246, Kellogg; Ibid n 246 Barnes & Krasnokutsky; Lyons, G, 'Shaken baby syndrome: a questionable scientific syndrome and a dangerous legal concept' (2003) 1109 *Utah Law Review* 1-22; Gena, M, 'Shaken baby syndrome: medical uncertainty casts doubt on convictions' (2007) 701 *Wisconsin Law Review* 1-26; Tuerkheimer, D, 'The next innocence project: shaken baby syndrome and the criminal courts' (2009) 87 *Washington University Law Review* 1-58.
[248] Cordner, S, personal communication, 2013.

applies to hypoxic damage, not physical trauma. This confusion and conflation in terminology affects thinking and research in triad deaths.

The following discussion will focus on the two elements of the triad that are thought to be indicative of trauma, SDH and RH, which form the basis for claims that the signs are caused by the deliberate act of shaking the infant, rather than from accidental or other causes. DAI/HIE is common in many conditions and therefore has not been the focus of clinical and research investigation into sign specificity to shaking or abusive head trauma. However, the discussion refers to both the triad and SDH and RH interchangeably, as that is the pattern in the medical literature. In addition, there is controversy about the term, SBS. Although there is now widespread agreement that SBS is an unhelpful characterisation, there is no agreed nomenclature in the medical community. The newer categorisations include inflicted traumatic brain injury (iTBI), abusive head trauma (AHT), shaken impact syndrome (SIS), and non-accidental head injury (NAHI).[249] For the sake of consistency, with later discussion of appellate judgments in cases of shaking or abusive head trauma, the term SBS will be used.

Before examining the merits of current medical knowledge about the triad and SBS and the extent to which the prosecution medico-legal reasoning is reliable, basic physiology and assumed clinical manifestations of SBS will be discussed.

4.1 The putative physiological effects of shaking: The basis for Shaken Baby Syndrome

The triad of injuries attributed to SBS involves the brain and the eyes. Three membranes enclose the brain and spine: the dura, pia, and arachnoid mater. The dura mater is the

[249] Reece, R, 'What Are We Trying to Measure: The Problems of Case Ascertainment' (2008) 34 *American Journal of Preventative Medicine* S 116.

outer layer of grey matter that covers the surface of the brain and the pia mater lies between the dura and arachnoid mater. The brain is attached to the skull with bridging or connecting veins. The retinal vein is a short vein that runs through the optic nerve and drains blood from the capillaries of the retina into the larger veins outside the eye. Infant brains are particularly vulnerable to injury if shaken, as the brain's incomplete development results in a smaller space between the brain and skull than found in older children or adults and in which greater acceleration can occur without injury. The infant brain is relatively small in size but the head represents one-fourth to one-third of body weight and has high water content. The head sits atop a weak neck, hence the need to support an infant's head. When the infant is shaken, the head flops down or back and forth against the chest and back. Proponents of SBS argue that this physiology makes infants particularly vulnerable to injury, especially closed head trauma. Violent shaking causes the brain to rebound against the skull which, in turn, causes the force that result in tearing, bruising, bleeding and swelling of the brain.

The retina is the multi-layered, inner lining of the eye.[250] The posterior pole of the retina encompasses the major blood vessels, the macula, the fovea, and the optic nerve head (the optic disc). The fovea is the area of the retina through which the central visual axis of the pupil falls. The macula surrounds the fovea. In infants, the vitreous gel that fills the eye adheres more strongly to the macula, peripheral retina, and the retinal blood vessels as they traverse the surface of the retina, than in older children and adults. This difference in anatomy of the infant eye makes it more vulnerable to damage than in adults and is relevant to understanding retinal haemorrhages in infants.

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[250] Togioka, B.M, Arnold, M.A, Bathurst, M.A, Ziegfeld, S.M, Nabaweesi, R, Colombani, P.M, Chang, D.C, and Abdullah, F, 'Retinal Hemorrhages and Shaken Baby Syndrome: An Evidence-Based Review' (2009) 37 *The Journal of Emergency Medicine* 98-106.

There are many clinical diagnostic observations relating to assumed SBS. In severe cases of shaking, the infant is thought to become rapidly unconscious or fall into a coma, followed by death.[251] Less severe forms of shaking might result in irritability and drowsiness and/or vomiting without diarrhoea. The eyes might show blood pooling, impaired tracking, or fixed pupils, or there may be no visible change. There may be reduced or no appetite, and poor sucking or swallowing resulting in choking. The infant's skin may appear bluish or pale, breathing may be irregular, and the infant might have trouble vocalising or smiling. There may be decreased muscle tone, swelling of the head, inability to lift or turn the head, or strange head position in relation to the infant's body. If the infant deteriorates, seizures, convulsions or altered consciousness might result. There are other less obvious signs such as abnormally low blood pressure, anaemia (deficiency in number or quality of red blood cells), abdominal or chest injuries, soft tissue swelling from underlying fractures, and swollen or tight fontanel due to brain swelling. There can be impact-induced fractures as well as other fractures such as to the collarbone, any long bones, and the back of the ribs. However, despite this constellation of potential injuries or signs, it has been suggested that physicians miss or misdiagnose abusive head trauma in one-third of infants seen in emergency or in private clinics.[252] Detection of abusive trauma is hampered by the fact that there may be no external

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[251] Minns, R.A, and Busuttil, A, 'Patterns of presentation of the shaken baby syndrome: Four types of inflicted brain injury predominate' (2004) 328(7442) *British Medical Journal* 766; Glass, R.B.F, Norton, K. I, Mitre, S. A, and Kang, E, 'Pediatric ribs: A spectrum of abnormalities' (2002) 22(1) *Radiographics* 87-104.

[252] Kemp, A.M, Stoodley, N, Cobley, C, Coles, L, and Kemp, K.W, 'Apnoea and brain swelling in non-accidental head injury' (2003) 88 *Archives of Disease in Childhood* 472-476; Jenny, C, Hymel, K. P, Ritzen, A, Reinert, S. E, and Hay,T .C, 'Analysis of missed cases of abusive head trauma' (1999) 281(7) *Journal of the American Medical Association* 621-626; Ewing-Cobbs, L, Kramer, L, Prasad, M, Canales, D.N, Louis, P. T, Fletcher, J. M, et al, 'Neuroimaging, physical and developmental findings after inflicted and non-inflicted traumatic brain injury in young children' (1998) 102(2) *Pediatrics* 300-307; Alexander, R, Crabbe, L, Sato, Y, Smith, W, and Bennett T, 'Serial abuse in children who are shaken' (1990) 144(1) *American Journal of Diseases of Children* 58-60.

evidence of injury, the signs and their onset vary widely between infants and can occur for reasons other than shaking.[253] The signs after the purported shaking may not occur immediately and may vary across days and weeks, especially if shaking was not severe. As many of the signs *can* occur in other conditions, SBS proponents argue that the infant's presentation may be (wrongly) attributed to these other causes, such as: persistent viral infections, influenza, dehydration, vitamin C or K deficiency, colic, problems with feeding, or sudden infant death syndrome.[254] A persistent problem with establishing whether the observed signs are due to shaking is that the act is usually not witnessed and the accuracy of events preceding sign onset cannot be verified, either because of deception or poor recall of events. The accurate ascertainment of inflicted injury is a significant problem for SBS research.

SBS has been diagnosed on the basis of the triad or co-occurrence of SDH and RH, and absence of external injury of sufficient magnitude to induce these two signs, such as a high-speed motor vehicle accident or fall from a high-story building.[255] Shaking-induced intracranial bleeding is most prominent in the inter-hemispheric fissure, although it can be found in other areas of the brain. If SDH is present, it can be easily missed, as the bleeding is shallow or contains a thin film bleed, rather than pools of blood. Diagnosing RH depends on ophthalmological investigation. RH may be present in multiple layers of the retina and vary widely between cases in terms of nature, size, severity, number and location. RH in infants, whose haemorrhages were known to have been birth-related, resolved anywhere between 1 week to several months but in

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[253] The finding of triad signss in infants who were *not* abused is a significant problem for the SBS hypothesis, which will be discussed later in the chapter.
[254] Ibid n 252, Jenny, Hymel, Ritzen, Reinert, & Hay.
[255] The definition of the SBS diagnosis has been imprecise, at times including brain swelling; at others a lack of adequate accidental traumatic explanation from the parent.

some cases, persisted for years.[256] Diagnosis of shaking involves excluding underlying conditions known to cause SDH and RH, including hydrocephalus, coagulopathies, or metabolic, inflammatory, thrombotic, or seizure disorders, among many other conditions.[257] These conditions increase vulnerability to damage from shaking, as well as producing signs thought to be characteristic of or to mimic SBS.

4.2 The advent of the Shaken Baby Syndrome

In 1971, Guthkelch, a paediatric neurosurgeon, proposed that violently shaking an infant can cause the triad of injuries by shearing or tearing the veins that bridge the gap between the brain and skull, which, in turn, can cause haematomas.[258] In the following year, Caffey, a paediatric radiologist, proposed that the triad was comparable to the injuries found in whiplash victims, and called it the 'whiplash shaken baby syndrome' to explain the traumatic intracranial bleeding found in severely injured infants. Caffey attributed the injuries to violently shaking an infant's body back and forth resulting in a whiplash motion of the child's head on the neck, although external signs of trauma might be absent.[259] Caffey assumed the injuries were the result of shaking without empirical support.[260] The diagnosis also required the presence of undetected long bone fractures, although this has been inconsistently applied over time in the medical literature. Caffey

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[256] Emerson, M.V, Pieramici, D.J, Stoessel, K. M, Berreen, J.P, and Gariano, R. F, 'Incidence and rate of disappearance of retinal hemorrhage in newborns' (2001) 108(1) *Ophthalmology* 36-39.
[257] Barnes, P. D, 'Ethical issues in imaging nonaccidental injury: Child abuse' (2002) 13(2) *Topics in Magnetic Resonance Imaging* 85-94; Rutty, G.N, Smith, C.M, and Malia, R.G, 'Late-form hemorrhagic disease of the newborn' (1999) 20(1) *American Journal of Forensic Medicine and Pathology* 48-51.
[258] Ibid n 236. Haemotoma is a localised swelling filling with blood.
[259] Caffey, J, 'On the theory and practice of shaking infants. Its potential residual effects of permanent brain damage and mental retardation' (1972a) 124(2) *American Journal of Diseases of Children* 161-169.
[260] Ibid n 259; Caffey, J, 'The parent-infant traumatic stress syndrome' (1972b) 114(2) *American Journal of Roentgenology* 218-229; Caffey, J, 'The whiplash shaken infant syndrome: Manual shaking by the extremities with whiplash-induced intracranial and intraocular bleeding, linked with residual permanent brain damage and mental retardation' (1974) 54(4) *Pediatrics* 396-403.

proposed that shaking *alone* was sufficient to cause the triad and the infant would rapidly lose consciousness so that the person in whose care the infant developed the triad was the likely perpetrator, especially if the event was unwitnessed. When the triad was accompanied by signs indicating the infant's head had struck a surface, such as skull fractures, the signs came to be known as 'shaken impact' or 'shaken slam' syndrome. The term 'Shaken Baby Syndrome' (SBS)[261] came into general medical use in the 1980s.[262]

Guthkelch and Caffey did not test whether their hypothesised mechanism of injury, shaking, *actually* caused the triad, despite asserting that it did so. Rather, they extrapolated the mechanical basis for SBS[263] from Ommaya's studies with rhesus monkeys.[264] Ommaya used an animal whiplash model to estimate the acceleration threshold needed to cause head injury (that is, concussion, SDH, and shear injury). Ommaya found that a gravitational force of 40 G ('G-force') was the threshold at which injuries were detected in the monkeys. The G-force of an object is its acceleration relative to free-fall.[265] Caffey *assumed* that manual shaking of an infant by an adult could generate these same forces, thereby producing the triad. Caffey also introduced the oft-cited claim, made by later physicians, that the force needed to cause the triad was comparable to a high-speed motor vehicle accident or fall from a high-story building. Again this was an assumption that was not supported by empirical evidence.

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[261] Recently, due to continued uncertainty that shaking is the actual cause of the triad, labels such as non-accidental head injury (NAHI) or inflicted traumatic brain injury (ITBI) has been proposed. This chapter will refer to SBS as it has been the prevailing term for the triad in the majority of research examined.
[262] See Ibid n 249.
[263] Uscinski, R. 'Shaken baby syndrome: fundamental questions' (2002) 16 *British Journal of Neurosurgery* 217-9.
[264] Ommaya, A, 'Whiplash injury and brain damage' (1968) 204 *Journal of the American Medical Association* 75-9.
[265] <http://newton.dep.anl.gov/askasci/phy99/phy99491.htm>

The reliability of Guthkelch and Caffey's claims depends on demonstrating that an adult can shake an infant, who was otherwise healthy, violently to death. Their claims were not supported by research *demonstrating* a causal link between shaking and the triad. In the years since Guthkelch and Caffey's hypothesis, there has been considerable debate within the medical community about the accuracy of this proposition. Caffey's explanation for the triad was based on untested assumptions and inferences, including that the infants were healthy before being shaken (although the events preceding the triad were usually unwitnessed), that *all* infants presenting with the triad experienced the same circumstances before developing the triad, the velocity and force required to cause the triad, and that the triad was unique to shaking. Most importantly, there was no independent verification by Caffey that shaking *was* the cause of the triad. Caffey's assertions were influential into the early 1990s, endorsed by child abuse paediatricians, with limited critical evaluation of his assumption that the triad was indeed distinctly characteristic of violent, angry shaking by the person in whose care the infant was when the triad developed.[266] Tuerkheimer, a legal scholar, argues that the notion that SBS was a detectable form of covert homicide with shaking-specific indicators was a myth perpetuated in child abuse literature.[267] Often there was no corroborating evidence that a crime had been committed beyond the triad. It has been observed that the triad was, in effect, 'a medical diagnosis of murder: prosecutors use it to prove the mechanism of death, the intent to harm, and the identity of the killer'.[268] She asserts that medical inquiry into SBS and its causes changed as other medical specialties became interested in diagnosis and research into SBS. As a result, alternative hypotheses and evidence have

[266] Ibid n 247, Tuerkheimer.
[267] Ibid n 247.
[268] Ibid n 247.

developed, challenging the apparently irrefutable mechanism of injury put forward by Caffey and his successors. It is likely that developments in medicine more broadly, such as an emphasis on science and evidence-based medicine, also contributed to opening up the debate on SBS and its cause.

4.3 Does shaking cause the triad?

The question of whether an infant was shaken or otherwise abused to the extent of developing the triad is difficult to prove because the events are usually unwitnessed. Physicians necessarily rely on the report of the parent or carer to determine whether the history provided is consistent with the observed injuries. The difficulty is that, without independent verification that indeed shaking does cause the triad, the physician is not well placed to make an accurate assessment of whether the explanation provided by the parent or carer accounts for the triad. The reliability of SBS as a diagnosis or causal explanation for the triad depends on proof of cause or mechanism of injury. However, to date, proof of inflicted injury has come from confessions, judicial convictions, apparently inconsistent histories and the expected signs of accidental trauma and witnessed trauma. All of these sources have their problems, primarily concerning reliability. The lack of independent verification of injury and death cause is a fundamental problem that affects any attempts, in research or clinical practice, to understand retrospectively the events that led to the triad and death. Even if inflicted injury is determined to some degree of certainty, there are doubts about the exact sequence of events preceding the assumed assault, the subsequent onset of signs and

death. Therefore, the reconstruction of the events preceding death poses innumerable issues in terms of accuracy.

The fact that some deceased infants present with a triad of injuries is not in dispute. The central and ongoing conundrum is whether the observed signs are from inflicted or accidental trauma. In cases of fatal accidental trauma there is a verifiable causal explanation (e.g. motor vehicle accident), while in inflicted trauma the cause is inferred from the triad and then correlated with fatal abuse. To date empirical confirmation of the hypothesised causal relationship between the triad and shaking, in the absence of other signs (e.g., injuries to ligaments and nerve roots of the cervical spine or fractures), has been elusive. If the decision to classify a case as fatal abuse or homicide depends on the triad itself, this is a form of circular reasoning that is flawed and likely to be vulnerable to confirmatory bias.[269] If homicide is not independently corroborated, there is a significant danger that cases deemed to reflect SBS will be wrongly classified and any conclusions about these cases will be misleading.

The following review of the literature indicates that prospective, retrospective, single case and case series designed studies have revealed significant correlations between SDH and RH and *assumed* inflicted injury. There are consistent findings that the frequency of SDH and severe RH is higher in SBS groups than in groups with injuries from other causes, such as accidental trauma. It is unknown whether the SBS group is correctly classified in the absence of independent corroboration. The critical question of

[269] Confirmatory bias is a psychological term referring to a tendency to evaluate evidence on the basis of pre-existing beliefs, rather than a more neutral evaluation that would assist in considering alternate theories or hypotheses. There is a more detailed discussion of medical decision-making biases in Chapter 7.

whether SDH and RH are *caused* by shaking, or other abusive head trauma, thereby constituting a criminal act, also remains in question.

4.4 Methodological issues in SBS research

4.4.1 Research design

Research into SBS is affected by several methodological problems that hinder the development of reliable methods for determining the cause of the triad. Firstly, there are difficulties with research designs involving case studies or case series analyses. Case studies are an in-depth analysis of a particular patient.[270] Case series, also called clinical series, is a descriptive study that evaluates patients in terms of diagnosis, and if that is the purpose of the study, their response to treatment. Case studies and series can be retrospective or prospective. Case series usually involve a smaller number of patients than designs such as case-control studies and randomised controlled trials. Case series may be consecutive or non-consecutive, depending on whether all cases presenting to the reporting authors over a period of time were included, or only a selection. Case studies and series can be confounded by selection bias, which limits conclusions that can be drawn about causality based on the correlations observed. Selection bias can occur when only cases of interest to the researcher are chosen, or those specifically referred to the researcher are chosen because of the researcher's interest or expertise in such cases. In this context, confirmation bias, assuming the case is consistent with the researcher's predominant theory or hypothesis, is a significant risk. Case studies or case series document observations of a particular case or cases and apply this understanding to other apparently similar cases. It is difficult to generalise from case studies to the wider

[270] Creswell, J.W, *Research Design: Qualitative, Quantitative and Mixed Methods Approaches* (Sage Publications, Thousand Oaks, 2003).

population. Often, case studies or series can lead to developing more controlled study designs to better test the researcher's hypothesis or theory. This type of research design describes or reveals what a condition is like in the individual(s) case but not *why* the condition occurs.

Conclusions based on case studies or a series of cases, which are reviewed by investigators who are not blind to the variables being measured inevitably, suffers from bias. This type of medical inquiry, a longstanding approach, differs from the evidence-based medicine approach favoured in modern medicine but is characteristic of the majority of research in clinical (or practical) medicine. Much of the literature connecting the triad to shaking alone consists of case studies in which the alleged perpetrator confessed to shaking the victim.[271] The relatively limited number of confessions has been relied on as proof that the triad is *always* and *only* caused by shaking. Generally, there are concerns about the reliability of confessions due to uncertainty about the circumstances of the confession – for instance, whether the admission was spontaneous or came after being confronted with seemingly irrefutable medical evidence that the infant died from inflicted causes. As confessions refer to events that are not directly observable by the researcher or clinician, there is doubt about reliability and application to the observed signs in the infant.

Questions of causality require other research methodology than case studies or case series designs. Quantitative methods allow more reliable comparisons to be made between the research group and the given patient, than case studies or series. Quantitative studies allow statistical calculations to be calculated to assess whether the

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[271] Leestma, J.E, 'Shaken baby syndrome: Do confessions by alleged perpetrators validate the concept?' (2006) 11(1) *Journal of American Physicians and Surgeons* 14-16.

study observations are valid and reliable. An often-used statistic is correlation, which indicates the strength of associations between variables thought to contribute to a phenomenon. Correlations, however, can only indicate whether an association exists and the strength of the association but not whether the relationship between the variables is causal. Finding causal relationships is essential in understanding medical processes, as knowledge about cause assists the development of treatment or intervention and prevention programmes.

In SUDI research, finding why some infants die suddenly is the critical question. The fact that SUDI occurs is not in dispute as this information is known from clinical and research reports. The issue is whether the mechanism of the death can be accurately determined so that reliability of death investigation, and ultimately, accuracy of assignment of cause of death can be improved. A retrospective study, commonly relied on in SBS research, suffers from similar problems of selection and confirmation bias as case studies/series. Prospective studies follow a group of similar individuals (cohorts) over time that differs with regard to certain factors being studied to determine how these factors affect rates of certain outcomes. Prospective studies are necessary to understand the aetiology of human disease or disorders, as it is unethical to expose humans to suspected risk factors in controlled experiments. Prospective studies tend to be ranked higher than retrospective studies on medical research (EBM) rating systems.[272]

The ideal research design to establish causal links between variables is a prospective, longitudinal study that measures various physiological and psychosocial

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[272] Atkins, D, Best, D, Briss, P.A, Eccles, M, Falck-Ytter, Y, and Flottorp, S, 'Grading quality of evidence and strength of recommendations' (2004) 328 *British Medical Journal* 1490. See Chapter 1, sub-section 1.1 for ratings table.

factors on all infants born at one (but preferably several) hospital(s) over a period of several years. This would provide a population base rate, or prevalence rate of factors, such as RH, which in turn helps to determine whether the characteristics of the infant being investigated are comparable to a population of infants. This type of design enables judgments to be made about whether RH is a common or unusual finding in infants. This type of design protects against researcher bias and provides information on normal characteristics of infants but such a study has not been conducted in SBS research.

4.4.2 Case ascertainment and base rates

The population prevalence of fatal abuse is difficult to estimate because of uncertainty about the accuracy of case ascertainment. The issue is further complicated by problems in SBS data. The incidence of and correlation between SDH or RH and SBS is needed to decide the strength of the observed association between these factors. In order to decide whether a correlation has predictive value, it is necessary to understand the base rate or prior probability of the relevant correlation in the group being studied, in this case the SBS group.[273] If the rate or prevalence of homicide is lower than the rate for other causes of the triad, even high correlations would not indicate that homicide was more likely than other injury mechanisms, as these signs appear in the non-homicide group as well as the homicide group. As the following discussion on SDH and RH will suggest, the presence of these signs is not unique to SBS, raising questions about the predictive value of these factors in determining whether a death constitutes homicide. If the base rate is ignored or unknown, the observed associations between signs and SBS will appear more meaningful or predictive than is actually the case, let alone being able to

[273] See discussion of base rates in Saks, M.J, and Risinger, D.M, 'Base rates, the Presumption of Guilt, Admissibility Rulings, and Erroneous Convictions' (2003) 4 *Michigan State Law Review* 1052-1063.

demonstrate a causal relationship. This is perhaps the most problematic limitation in SBS research and seriously questions derivative conclusions about the triad.

Another problem in accurate case ascertainment is the conflation between an absence of medically convincing explanation and the diagnosis of SBS. If a parent does not have an adequate explanation for the triad injuries, it is assumed that the case constitutes inflicted injury. This implies that the mechanism underlying the triad is known and being unable to explain the triad is inculpatory. It is thought that the reliance on the triad to prove SBS has led to an overestimation of its incidence. This type of error can create the illusion that SDH or RH is predictive of SBS, despite these signs being present in other conditions.

4.4.3 Reviews of medical research on SBS

The methodological concerns about SBS research are pervasive and largely unresolved, despite the hundreds of articles published on this subject. There have been several extensive reviews of research on SBS. The reviews fall into two opposing views on specificity and causation of the triad. One view, encapsulated by Narang,[274] argues that the triad is specific to and predictive of SBS; the other view, represented by Donohoe and Squier,[275] cautions that there are many conditions in which the triad can occur and research to date does not definitively establish a causal link between shaking and the triad or that the triad is specific to shaking injuries. The debate intensified in a recent publication by Findley and colleagues, including Squier,[276] who, not unexpectedly,

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[274] Narang, S.K.A, 'Daubert Analysis of Abusive Head Trauma/Shaken Baby Syndrome' (2012) 11 *Houston Journal of Health Law and Policy* 505-633.
[275] Ibid, n 49, Donohoe; Squier, W, 'Shaken baby syndrome: the quest for evidence' (2008) 50 *Developmental Medicine & Child Neurology* 10–14.
[276] Findley, K.A, Barnes, P.D, Moran, D.A, and Squier, W, 'Shaken Baby Syndrome, Abusive Head Trauma, and Actual Innocence: Getting it Right' (2012) Paper No. 1195 *Legal Studies Research Paper Series*.

concurred with Donohoe and Squier's earlier reviews and strenuously questioned the empirical basis for concluding that the triad is caused by shaking.

In his review of research into SBS, Donohoe identified 1998/1999 as the turning point at which EBM came to the fore in SBS literature.[277] Donohoe argued that the advent of EBM shifted physicians' focus from primarily clinical or practical experience-based knowledge to experience or knowledge based on rigorous scientific and statistical research. During the rise of EBM, researchers uncovered a significant error in the way SBS was studied before 1999: subjects were chosen for inclusion in studies based on the presence of SDH and RH which were, without any other verification, assumed to be caused by shaking the infant. These studies found their case selection as pathognomonic of shaking because the cases were selected on the basis of SDH and RH, both thought to be caused by shaking.[278] This circularity of reasoning is a fundamental problem in SBS research predating 1999, and subsequently, as there is no independent corroboration that demonstrates shaking causes SDH and RH.

Donohoe applied the EBM rating system to his review of scientific research on SBS from 1966 to 1998. By these criteria, the majority of the medical research only reached Level IV or clinical opinion with little evidence of more standardised or objective measures of the triad. He concluded that the quality of the research is such that it does not support any firm conclusions about the cause of the triad:

> *As in SIDS research, there are methodological problems in SBS research. The issue of the evidence for SBS appears analogous to an inverted pyramid, with a 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. One may need reminding that*

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[277] Ibid n 49, Donohoe.
[278] Ibid n 49, Donohoe, 239.

> *repeated opinions based on poor-quality data cannot improve the quality of evidence…there is inadequate scientific evidence to come to a firm conclusion on most aspects of causation, diagnosis, treatment, or many other matters pertaining to SBS.*[279]

Donohoe concluded the majority of the research reviewed consists of clinical opinions that did not advance knowledge about SBS. Many of the researchers repeated the logical flaw that if RH and SDH are *nearly always* seen in SBS, the presence of RH and SDH 'proves' or is a unique indicator that a baby was shaken intentionally. The critical question is whether RH and SDH reliably discriminate between SBS and other causes of injury. Many other studies assumed that the presence of RH and SDH was sufficient to make the diagnosis of SBS in terms of case selection.

Similarly, Squier[280] reviewed the evidence for SBS and concluded that research into the triad has many flaws: study results are based on correlations (which can only show that certain variables are associated but not whether there is a causal relationship); there are no prospective studies; biomechanical studies suggest that impact is needed to create the triad as shaking is insufficient in force; and biomechanical studies that have tried to model the forces speculated to lead to the triad have failed to create the triad predicted from rapid and deceleration force impacts. Like Donohoe, Squier emphasises the poor quality of the triad research base. Squier argues that hypoxaemia decreased partial pressure of oxygen in the blood (Geddes' hypothesis described below) was a more plausible explanation than shaking, as infants with the triad do not have the deep unilateral blood clots observed in a severe head injury.

Leestma, another reviewer, questioned the merits of relying on confessions to

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[279] Ibid n 49, Donohoe.
[280] Ibid n 275, Squier.

substantiate the mechanism of injury in triad injuries. She argues that there are a number of methodological problems that undermine the validity of confirming mechanism of death from confessions, in that if a caretaker stated they had shaken the baby, the force, and the length of time before injury and death, and whether the baby's signs preceded or followed the shaking was not clear.[281] This review highlights the difficulty in accurately establishing how the triad came to occur, given that there is no independent verification or standard against which diagnosis of inflicted injury can be measured.

Narang,[282] on the other hand, argues that clinical medical research cannot be expected to reach the highest level of the EBM (Level I), due to ethical constraints. He asserts that repeated observations of clinical findings, whether case studies or series, across a span of time and across hospital centres and countries amounts to a strong evidentiary base for concluding that SDH and RH primarily occur after abusive behaviour. Narang advocates for greater reliance on clinical judgment (Level IV), as more rigorous or scientific research is difficult to conduct in this area of medicine.[283] He proposes that child abuse paediatricians, who support the SBS hypothesis and cite literature that also supports their judgment, are better placed than other medical, scientific communities to assess and diagnose the cause of the triad. He compares the clinical judgment needed to understand the triad to clinical approaches to the diagnosis and treatment of migraines,[284] which also lacks validation via randomised control trials and is uncontroversial. However, clinical judgment in triad cases operates without the benefit of feedback from the patient and the medical evidence or knowledge is highly

[281] Ibid n 271, Leestma.
[282] Ibid n 274, Narang.
[283] Ibid n 274, Narang, 579-580.
[284] Ibid n 274, Narang, 531-532.

controversial and contradictory. The comparison does not seem relevant for triad cases. Despite repudiating scientific or more rigorous methodologies, Narang's analysis of research relies on statistical significance and scientific research designed to fortify his conclusions about observed associations between SDH, RH and shaking. He applies the very scientific and statistical methodologies that he rejects, preferring clinical opinion evidence to support his view that SDH and RH are strongly correlated with assumed shaking mechanism of injury, thereby proving a causal relationship between the triad and SBS. Aside from the inconsistency of Narang's reasoning, correlations cannot demonstrate causal relationships.

Narang's exhaustive review of studies on SDH, RH and shaking does challenge the assertions made by Donohoe and Squier about the flaws in SBS research. Narang has rightly criticised Donohoe on several grounds, particularly that he limited his database search term to 'SBS' only and his lack of analysis of the studies relied on to form his opinions. Narang adopted a wider set of definitions, including abusive head trauma (AHT) and 14 other key words, and conducted a Medline search from 1970 to 2010. He culled the results to 700 articles, which specifically focussed on SDH and RH. He identified several prospective studies, derived from longitudinal follow-up studies of infants. However, it will be shown below that these are not true prospective studies; rather they are prospective case series analyses or epidemiological or descriptive studies. Narang argues that there is a strong research base to support the notion that SDH and SBS are statistically significantly and highly correlated. He presents a series of studies in which SDH and RH are significantly more prevalent in the assumed SBS groups than the accidental injury groups. The prospective studies and those addressing the specificity of SDH and RH to shaking or abusive behaviour will be discussed later in this chapter.

There are limitations to Narang's methodology, specifically the statistical analysis of the data included in the papers he has reviewed. The studies primarily rely on chi-square analyses of the frequency of signs, such as SDH, in accidental injury cases compared to assumed SBS cases. This statistic tests whether the observed differences in frequency of signs in each group is a real difference, as opposed to chance variation. A chi-square analysis does not prove that shaking caused the triad; it simply demonstrates that SDH is significantly more frequent in the SBS group. Notably, SDH and RH are also found in accidental injury cases. This suggests that SDH and RH are more frequent in cases of *assumed* fatal abuse than in accidental cases, but these signs are not specific to shaking and it is not clear that the SBS cases are actually instances of fatal shaking. Narang relies on circular reasoning to prove shaking causes the triad – an error that pervades triad research that depends on this reasoning to ascertain cases of SBS – meaning his analysis and conclusions are also flawed. It is not clear that the cases categorised as SBS, *are* actual cases of inflicted fatal injury. Narang has also failed to take into account base rates of SDH and RH, which indicate that neither sign is specific to homicide, making it difficult to interpret the higher frequency of SDH and RH in the assumed SBS group.

The most troubling aspect of Narang's analysis is that it does not deal with the ongoing and unresolved issue of independent verification of shaking as the mechanism of injury. This is an important omission, as the many studies conducted between 1970 and 2010 have not resolved the key issue of independent verification of the cause of the triad. The studies Narang cites in support of SBS have authenticated inflicted injury from confessions, judicial decisions, and histories inconsistent with the observed signs. This means that there is no certainty that the SBS group refers to the same causal process in each case, that the deaths constituted homicide, the group itself is heterogeneous, and

findings of higher frequency of SDH and RH is difficult to interpret. Consequently, it could be that there are various events leading to SDH and RH and conclusions about causal relationships between SDH and RH and SBS are premature. The types of confirmation of SBS that Narang relies on are not independently verifiable by clinicians or researchers, leaving significant uncertainty about the meaning of associations or correlations based on this method of classifying cases as SBS. This is also the substance of the strident criticism expressed by the most recent review of the SBS literature.[285]

The following section examines research evidence on SDH and RH, particularly about the nature and course of SDH, lucid intervals post-injury, RH, and the relevance of external injury or its absence.

4.5 Subdural haemorrhages

SDH of traumatic origin occur when the head strikes a surface or an inertial force (acceleration-deceleration) occurs or both.[286] The impact can cause a fracture of the skull or damage the inner membranes and underlying blood vessels causing haemorrhages, although this is not always the case. Apart from many descriptive studies correlating

[285] Ibid n 276, Findley, Barnes, Moran and Squier.
[286] Rorke-Adams, L, Duhaime, C, Jenny, C, and Smith, W, 'Head Trauma' In Reece, R.M, and Christian, C.W, (Eds.) *Child Abuse: Medical Diagnosis & Management* (American Academy of Pediatrics, 2009) 53-119.

SDH and shaking, there are two population studies on SDH, one by Feldman et al[287] and the other by Hobbs et al.[288]

Feldman and colleagues' research examined children admitted with SDH to two Seattle hospitals over a span of four years. The study sample consisted of 66 children aged less than 3 years. Children presenting with SDHs secondary to known bleeding disorders, birth-related brain injury, or infection were excluded. RH was excluded as a selection criterion for determination of abuse to avoid circularity of reasoning. The cause of SDH was confirmed on a scale from 'definite unintentional' to 'definite abuse'.[289] A case was assigned the 'definite abuse' category when the causal event was corroborated, witnessed or was confessed to, or there were multiple unexplained injuries, especially with cranial impact, without adequate history and developmentally inconsistent mechanisms were proposed by the carer. 'Highly likely abuse' was assigned when there were multiple injuries of various ages, questionable and developmentally inconsistent history. 'Likely abuse' (lowest abuse suspicion category) referred to a single injury, minor or no event history, signs of more global brain injury with possible associated injuries but limited to retinal bleeding, or single impact bruising. Unintentional cause of SDH, also on a scale from 'definite' to 'likely', was assigned when there was a witnessed or otherwise reliably corroborated event or the SDH was isolated and accompanied by a developmentally and mechanically consistent history. However, despite the scale, the three abuse and three unintentional groups were combined either into one category called 'abuse' or one called 'unintentional' in order to attain sufficient numbers for statistical

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[287] Feldman, K.W, Bethel, R, Shugerman, R.P, Grossman, D.C, Grady, M.S, and Ellenbogen, R.G, 'The Cause of Infant and Toddler Subdural Hemorrhage: A Prospective Study' (2001) 108 *Pediatrics* 636 – 646.
[288] Hobbs, C, Childs, A.M, Wynne, J, Livingston, J, and Seal, A, 'Subdural haematoma and effusion in infancy: an epidemiological study' (2005) 90 *Archives of Diseases in Childhood* 952–955.
[289] Ibid n 287, Feldman et al, 638.

analysis. In their sample of 66 children, abuse (combined categories) was confirmed in 59% of cases, accidental or unintentional (combined categories) in 23%, and undetermined in 18% of cases. The accidental injuries were mainly due to motor vehicle accidents or other documented major trauma. Chronic or mixed acute and chronic SDH was found in 44% of the abuse group, 67% of the indeterminate injuries group, and 0% of the unintentionally injured group. 51% of the abuse group had long bone or rib fractures, while only one child in the unintentional group had these injuries. 72% of the abuse group had retinal bleeding. The researchers found that some 20% of children with unintentional trauma also had SDH. This is a considerable number, given the small sample size. Furthermore, combining the abuse and unintentional categories makes it difficult to interpret the meaning of the rates of SDH in *either* group. The study demonstrated a higher rate and chronicity of SDH in the assumed abused group but did not show that SDH was specific to abuse or caused by abuse. Narang reported this study as confirming the 'predominance of Non-Accidental over Accidental Injury as the aetiology of SDHs'.[290] This study suggests that SDH in a sample of infants occurs more often in the abuse group relative to an unintentional group. It does not prove, however, that abuse is causally linked to SDH or even whether the assumed abuse group was actually abused. As the researchers did not use blind assignment to groups, the risk of selection bias is high. The study represents, in effect, an analysis of SDH and its characteristics in a cohort selected for the fact that it has SDH. A stronger study design for determining aetiology would be to follow *all* infants born at a hospital, or hospitals, and describe the base rate (or population prevalence) of factors such as SDH, RH, and so on over a period of time. This approach enables a population base rate to be calculated,

[290] Ibid n 274, Narang.

which in turn would help to understand the meaning of higher frequencies of SDH in cases of abuse, if that is actually observed when cases are not selected because of SDH, an approach that reduces the risk of selection bias. Screening out RH does not obviate the risk that cause and effect have been conflated.

Hobbs and his colleagues[291] described SDH in a cohort of 186 infants under 2 years who were admitted or who died across the span of 12 months in the UK and Republic of Ireland. Their aim was to determine the incidence, aetiology and clinical features of SDH in infancy across the British Isles, as well as investigating injury mechanisms other than shaking or non-accidental injury. The referring physicians were sent a questionnaire asking for their opinion on the aetiology of SDH, based on full multidisciplinary social investigation, ophthalmological and skeletal examination, coagulation screen, and computerised axial tomography (CT) or magnetic resonance imaging (MRI) examination. The researchers identified 186 cases of SDH out of 372 notifications. The annual incidence of SDH for the UK and Republic of Ireland was 12.54/100,000 aged 0 - 2 and 24.1/100,000 aged 0 - 1. Of these 186 cases, 106 were categorised as caused by abuse compared to seven cases attributed to accidents. The diagnosis of SBS or non-accidental head injury, as well as other aetiologies, such as accident or disease, was based on retrospective clinical opinion. The researchers note the difficulty in ascertaining the true cause of SDH, but note that SBS cases were more thoroughly investigated. A thorough investigation, *per se*, does not resolve the problem of accurate ascertainment of cases. The researchers concluded that trauma (at birth, post-natally following an accident or non-accidentally) was the most common cause of SDH at 75%. Other evidence such as bruises and fractures without adequate history was also

[291] Ibid n 288.

relied on to confirm homicide. This study provides an estimate of the population prevalence of SDH, with SDH most frequently being present after trauma, of *any* kind. SDH was more prevalent in the assumed non-accidental trauma (SBS) group than other groups. The limitation of this study is the reliance on the clinician's opinion on the cause of SDH (and the group to which the case was assigned) and the lack of standardised and blind assignment of cases to the various injury cause groups, leaving it open to confirmation and selection bias. However, the study results are consistent with other studies in indicating that SDH is more common in cases of inflicted injury without, again, resolving the inherent problem that accuracy of case ascertainment is unknown.

Consistent with Narang's review, there is agreement between the many SBS studies, including Feldman and Hobbs' and colleagues' studies, that SDH is more common in cases ascertained to be a result of abuse. The merits of these findings depend on whether cases have been correctly defined as abuse or accidental. At best, these studies suggest that shaking or abusive trauma should be *considered* when an infant presents with SDH and there is strong evidence that SDH and abusive trauma are correlated.[292] However, the studies do not answer the critical question of whether shaking or abuse *caused* the SDH or whether assumed inflicted trauma or injury was correctly categorised.

4.5.1 Subdural haemorrhage and bridging vein shearing

Integral to the SBS hypothesis is the concept that the movement of the brain during shaking shears off the large veins between the brain and the dura, causing SDH. These large veins, the bridging veins (BV), are substantial and move blood from the brain to

[292] Another problem is the application of epidemiological conclusions to individual cases, which might not conform to statistical findings in epidemiological studies.

the dural sinuses. There are approximately 10 to 20 BVs between the brain and the dura.[293] Autopsy photos indicate that BVs are large and appear to stretch substantially.[294] This means that if torn or sheared BVs were the cause of SDH, as posited in the SBS hypothesis, there would be a large collection of blood in SBS cases at autopsy or on CT scan in SBS cases. This has not been found in assumed SBS cases.[295] Instead, smaller collections of blood, or 'thin films', are seen in the subdural space. Large bleeds are relatively contained due to lower capillary pressure compared to BVs with higher pressures that increase the mass of extravasated blood, resulting in massive SDH. The anatomical knowledge of the brain does not support shearing of bridging veins, the mechanism proposed by the SBS hypothesis, as a likely cause of observed characteristics of SDH. SDH begins as intradural haemorrhage (IDH) and is caused by physical or physiologic damage to the dural capillary plexus.[296] If an infant has a pre-existing haemorrhage of *any* aetiology and chronic SDH has developed, shaking or normal handling can cause a spontaneous re-bleed of the previous SDH. Vinchon et al[297] found 10% of all SDH cases over a three-year period in their hospital had spontaneous re-bleeds without any evidence of abuse. Cohen and Scheimberg demonstrated that trauma is not the only aetiology of SDH, as:

> *SDH and cerebral hypoxia are common associations of IDH and that SDH (often seen as a thin film of haemorrhage) almost always occur in association with diffuse falcine IDH. Diffuse IDH*

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[293] Greenes, D.S, and Schutzman, S.A, 'Occult intracranial injury in infants' (1998) 32(6) *Annals of emergency medicine* 680-686
[294] Maxeiner, H, 'Demonstration and interpretation of bridging vein ruptures in cases of infantile subdural bleedings' (2001) 46 *Journal of Forensic Science* 85-93.
[295] Ibid n 275, Squier.
[296] Mack, J, Squier, W, and Eastman J.T, 'Anatomy and development of the meninges: implications for subdural collections and CSF circulation' (2009) 39 *Pediatric Radiology* 197-8.
[297] Vinchon, M, Delestret, I, DeFoort-Dhellemmes, S, Desurmont, M, and Noulé, N, 'Subdural hematoma in infants: can it occur spontaneously? Data from a prospective series and critical review of the literature' (2010) 26 *Child Nervous System* 1195-1205.

with SDH are more frequently associated with severe or moderate hypoxic ischemic encephalopathy (HIE), while mild or early HIE is more common with focal IDH without SDH.[298]

Perinatal SDH (PSDH) was found in 46% of 'normal' newborns screened at birth,[299] suggesting a very high base rate of SDH in early infancy. If PSDH persists, progresses, or is complicated, neuropathic events occur, including ALTE usually between 6 weeks and 6 months of age.[300] When SDH is found, despite the high base rate of these signs after birth, child abuse specialists infer that the cause is SBS and intentional abuse, rather than other aetiologies. Further, unresolved PDSH can become chronic SDH and wrongly assumed to be due to abuse. There is little, if any consideration of any predisposing or complicating factors in the SBS literature, and there is rarely any indication of the timing of eye exams relative to the clinical course of signs or brain imaging, all factors which can affect the signs/injuries detected. From the research and clinical evidence base, it may be concluded that: (1) SDH is not specific to SBS, (2) SDH can occur in accidental injury and medical conditions, and (3) predisposing factors and complicating cascade effects must be considered in the pathophysiology of SDH.

4.5.2 Alternative explanations to shearing bridging vein theory of SBS

SBS is not, as its name erroneously implies, a 'syndrome' that only manifests when there is shaking trauma. Instead, SDH and RH were evident in several different forms of brain

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[298] Cohen, M.C, and Scheimberg, I, 'Evidence of Occurrence of Intradural and Subdural Hemorrhage in the Perinatal and Neonatal Period in the Context of Hypoxic Ischemic Encephalopathy: An Observational Study from Two Referral Institutions in the United Kingdom' (2009) 12 *Pediatric and Developmental Pathology* 169-176.

[299] Rooks, V.J, Eaton, J.P, Ruess, L, and Petermann, G.W, Keck-Wherley, J, and Pederson, R.C, 'Prevalence and Evolution of Intracranial Hemorrhage in Asignatic Term Infants' (2008) 29 *American Journal of Neuroradiology* 1082-1089.

[300] Mittal, M.K, Shofer, F.S and Baren, J.M, 'Serious Bacterial Infections in Infants who have Experienced an Apparent Life-threatening Event' (2009) 54 *Annals of Emergency Medicine* 523 -7.

injury, with different clinical history and neuropathology, involving mechanisms other than shaking.[301] A series of independently witnessed accidents confirmed that, as claimed by parents, minor falls could cause an acute SDH with the RH being due to a sudden rise in retinal venous pressure.[302] Additionally, parental histories of a preceding episode of respiratory collapse were consistent with the very different pathological findings of anoxic (oxygen loss) brain damage, and associated disturbance of the microcirculation causing thin film SDH and RH.[303]

Geddes, a neuropathologist, and her colleagues, conducted a series of studies that have proved to be controversial in both medical and legal communities.[304] The first set of findings, named 'Geddes I' in the literature, were based on the examination of the autopsies of 53 victims of alleged SBS[305] in which 37 were infants (ages < 9 months) and 16 were children (aged 13 months to 3 years). 29 had evidence of impact with only one case of admitted shaking. On microscopic examination, Geddes did not find widespread and severe traumatic brain damage, assumed to be characteristic of shaken deaths. She did observe cerebral swelling but found it was more often due to diffuse axonal injury (DAI) of hypoxic-ischemic encephalopathy (HIE) – a condition in which the brain has an insufficient supply of oxygenated blood supply – rather than shearing or traumatic axonal injury (TAI), which, in the SBS hypothesis, is thought to cause deep bleeds. Although Geddes found fractures, thin film SDH (e.g. dural vascular plexus

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[301] Geddes, J.F, and Plunkett, J, 'The evidence base for shaken baby syndrome' (2004) 328 *British Medical Journal* 719–20; Le Fanu, J, and Edwards-Brown, R, 'Subdural and retinal haemorrhages are not necessarily signs of abuse' (2004) 328 *British Medical Journal* 767.
[302] Plunkett, J, 'Fatal pediatric head injuries caused by short distance falls' (2001) 22 *American Journal of Forensic Medical Pathology* 1–12.
[303] Geddes, J.F, and Whitwell, H.L, 'Head injury in routine and forensic pathological practice' (2001) 95 *Current Topics in Pathology* 101– 24; Adams, G, Ainsworth, J, Butler, L, et al, 'Update from the ophthalmology child abuse working party: Royal College of Ophthalmologists' (2004) 18 *Eye* 795–8.
[304] See discussion in Chapter 5 for appellate cases relating to SBS.
[305] Geddes, J. F, Hackshaw, A, Vowles, G, Nickols, C.D, and Whitwell, H. L, 'Neuropathology of inflicted head injury in children. I. Pattern of brain injury' (2001) 124 *Brain* 1290-8.

origin), and RH, the usual medical cause of death was increased intracranial pressure from brain swelling associated with HIE or oxygen loss. In infants with impact injuries, cervical (neck) epidural haemorrhage and focal axonal brainstem, cervical cord, and spinal nerve root injuries were characteristically seen. The researchers proposed that upper cervical cord/brainstem injury may result in apnoea or respiratory arrest and be responsible for the HIE.[306] In the 16 older victims (ages 13 months to 8 years), the pathology findings were primarily those of abusive head trauma in children or adult trauma syndrome, including extra-cranial injuries, large SDH (i.e. as would be expected with bridging vein rupture), and TAI.

The second set of neuropathological findings, 'Geddes II', by Geddes and colleagues[307] revealed that SDHs are also seen in non-traumatic foetal, neonatal, and infant brain injury cases and such SDHs are actually of intradural vascular plexus (network of nerves and blood vessels within the dura mater) origin, rather than bridging cortical vein (veins attached to scalp) origin. Geddes concluded that the there is scant scientific evidence to support a traumatic origin for brain damage in assumed shaken death. Geddes argues that the problem with the SBS bridging vein shearing theory in shaking trauma is that it is difficult to tear these veins and when they do tear, the haemorrhages lead to deep pools of blood rather than the thin film SDH seen in supposed SBS cases. Apparent traumatic tearing of axons can also occur from non-traumatic causes of hypoxic axonal injury, such as dysfunction in the heart or lungs, or widespread

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[306] See forthcoming discussion of biomechanical research that predicts neck/cervical injury if an infant is shaken with sufficient force.

[307] Geddes, J. F, Vowles, G, Hackshaw, A, Nickols, C. D, and Whitwell, H.L, 'Neuropathology of inflicted head injury in children. II. Microscopic brain injury in infants' (2001) 124 *Brain* 1299-1306; Geddes, J.F, Tasker, R.C, Hackshaw, A.K, Nickols, C.D, Adams, G.G.W, Whitwell, H.L, and Scheimberg, I, 'Dural haemorrhage in non-traumatic infant deaths: does it explain the bleeding in 'shaken baby syndrome'?' (2003) 29 *Neuropathology and Applied Neurobiology* 14 -22.

infection (sepsis). Geddes I and II raised the possibility that brain findings attributed previously to traumatically torn axons from violent shaking might be due hypoxia-ischaemia from any medical condition that restricts the flow of oxygen to the brain. These findings also raise issue with the timing of the traumatic event, in that, if brain damage was *secondary* to loss of oxygenated blood from *any* source, it was difficult to estimate the time it would take for the resultant brain swelling to lead to collapse when the body could no longer meet the brain's basic need for oxygen.

The common denominator in all these cases is likely a combination of vascular immaturity and fragility further compromised by HIE or infection, cerebral venous hypertension or congestion, arterial hypertension, and brain swelling. This led Geddes, in 2003, to suggest an alternate hypothesis, called the 'unified hypothesis' or 'Geddes III'. She suggested that the thin film SDH seen in SBS may not be the result of traumatic rupture of bridging veins (which causes thick unilateral space occupying clots) but might occur when intracranial vessels are damaged by hypoxia in the presence of abnormal haemodynamic forces such as venous hypertension, systemic arterial hypertension, or episodic surges of blood.[308] Essentially, Geddes proposed that SDH and RH found in natural deaths and alleged SBS cases might reflect a *cascade* of events, such as raised intracranial pressure, central venous and systemic arterial hypertension, immaturity, and hypoxia-related vascular fragility.

[308] Ibid n 307, Geddes, Tasker, Hackshaw et al.

Geddes' III was met with strident criticism,[309] and the English and Wales Court of Appeal rejected the unified hypothesis.[310] The problem seems to be that Geddes III hypothesised *alternative* mechanisms of injury to shaking to explain neuropathological findings, while Geddes I and II described post-mortem anatomical results without proposing other injury mechanisms. Geddes I and II were accepted in legal and medical communities.[311] Although Geddes herself admitted, in her appearance at the appeal, that her hypothesis was just that, there continues to be a general rejection of her theory as unfounded or lacking in credibility, despite most scientific and clinical research progressing along similar lines: that is, developing and testing hypotheses.[312] Furthermore, research by Cohen and Scheimberg,[313] and Croft and Reichard,[314] and others has replicated Geddes' results. In their post-mortem series, Cohen and colleagues described 25 foetuses (26 - 41 weeks) and 30 neonates (1 hour - 19 days) with HIE who also had macroscopic intradural haemorrhage (IDH), including frank parietal SDH in two-thirds of cases. They concluded, along with the findings of other cited researchers, that IDH and SDH are commonly associated with HIE, particularly when associated with increases in central venous pressure. The researchers thought this might also explain the frequency of RH associated with perinatal events.[315]

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[309] David, T.J, 'Non-accidental head injury: the evidence' (2008) 38(Suppl 3) *Pediatric Radiology* S370-7; Jaspan, T, 'Current controversies in the interpretation of non-accidental head injury' (2008) 38(Suppl 3) *Pediatric Radiology* S378-87; Byard, R, Blumbergs, P, Rutty, G, Sperhake, J, Banner, J, and Krous, H.F, 'Lack of evidence for a causal relationship between hypoxic-ischemic encephalopathy and subdural hemorrhage in fetal life, infancy, and early childhood' (2007) 10 *Pediatric & Developmental Pathology* 348-50.
[310] Ibid n 8, Harris.
[311] See Ibid.
[312] See Chapter 4 for discussion of Geddes' work in appellate judgments.
[313] Ibid n 298.
[314] Croft, P, and Reichard, R, 'Microscopic examination of grossly unremarkable pediatric dura mater' (2009) 30 *American Journal of Forensic Medicine & Pathology* 10-13.
[315] Ibid 256, Emerson et al.

Geddes III has led to ongoing debate within the medical community, divided between those who supported the 'accepted' hypothesis of SDH and those who did not. The 'accepted' hypothesis,[316] being Caffey's original hypothesis of shearing/tearing injury, via acceleration and deceleration forces causing SDH and RH leading to unconsciousness and, ultimately, death as the brain ceases to be perfused with blood. As the following discussion of biomechanical research suggests, the main problem with the accepted hypothesis is that biomechanical studies have been unable to confirm the force necessary to create SDH and RH in an infant brain.

4.5.3 The role of force and velocity in SDH: Biomechanical studies

Biomechanical studies attempt to approximate the human brain by using an anthropomorphic test device (ATD). The ethical constraints of controlled studies mean that approximation of the human brain is the typical means to describing the effect of force on the brain. Duhaime and colleagues[317] measured the angular accelerations associated with adult manual shaking (i.e. 11 G) and impact (i.e. 52 G) in a 1 month old infant ATD. Only accelerations associated with impact (four to five times higher than that associated with shaking) on an unpadded or padded surface exceeded the injury thresholds determined by Ommaya. In the same study, Duhaime and colleagues reported a series of 13 fatal cases of assumed SBS in which all had evidence of blunt head impact, more than half of which were noted only at autopsy.[318] The investigators concluded that shaking alone does not cause severe central nervous system injury, as found in assumed SBS cases. Duhaime and colleagues' results contradicted many of the original reports

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[316] Ibid n 275, Squier.
[317] Duhaime, A, Gennerelli, T, Thibault, L, Bruce, D.A, Margulies, S.S, and Wiser, R, 'The shaken baby syndrome. A clinical, pathological, and biomechanical study' (1987) 66 *Journal of Neurosurgery* 409-15.
[318] Ibid.

that proposed the whiplash mechanism caused the triad. They suggested the use of the new term, shaken impact syndrome. The term is also used when there are additional signs suggesting the infant's head had been struck against a solid surface (such as severe cranial bruising or fractures).

More recently, Prange and colleagues,[319]using a 1.5 month-old ATD, showed that brain injury is more likely with inflicted or deliberate impacts against hard surfaces, than from falls from less than 1.5 m or from vigorous shaking. With further improvements in ATDs, recent experiments indicate that maximum head accelerations needed to cause injury may occur at lower fall heights than previously thought.[320] That is, falls from lower heights accompanied by acceleration forces can cause severe head injury.

Critics of the Duhaime and Prange studies argue that there is no adequate human infant replica yet designed to properly test shaking versus impact.[321] However, other reports also show that shaking alone cannot result in the triad unless there is concomitant injury to the neck, cervical spinal column, or cervical spinal cord, as these are the weak links between the head and body of the infant.[322] Bandak has shown that neck failure or injury will occur before brain injury, yet most SBS cases do not have

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[319] Prange, M, Coats, B, Duhaime, A, and Margulies, S.S, 'Anthropomorphic simulations of falls, shakes, and inflicted impacts in infants' (2003) 99 *Journal of Neurosurgery* 143-50.
[320] Leestma, J, *Forensic neuropathology* (Boca Raton (FL): CRC Press, 2nd Ed, 2009) 603.
[321] Pierce, M.C, and Bertocci, G, 'Injury biomechanics and child abuse' (2008) 10 *Annual Review of Biomedical Engineering* 85-106.
[322] Ommaya, A, Goldsmith, W, and Thibault, L. 'Biomechanics and neuropathology of adult and paediatric head injury' (2002) 16 *British Journal of Neurosurgery* 220-42; King, W, MacKay, M, and Sirnick, A, 'With the Canadian Shaken Baby Study Group Shaken Baby Syndrome in Canada: Clinical characteristics and outcomes of hospital cases' (2003) 168(2) *Canadian Medical Association Journal* 155-159; Bandak, F.A, 'Shaken baby syndrome: a biomechanics analysis of injury mechanisms' (2005) 151 *Forensic Science International* 71-9; Barnes, P, Krasnokutsky, M, Monson, K, and Ophoven, J, 'Traumatic spinal cord injury: accidental vs. non-accidental injury' (2008) 15 *Seminars in Pediatric Neurology* 178-84.

concomitant neck injury.[323] Research conducted by Barnes and colleagues shows that spinal cord injury without radiographic abnormality or not evident on x-ray or CT scans, is an example of primary neck and spinal cord injury with secondary brain injury, regardless of whether the injuries were accidental or non-accidental in origin.[324] As infants lack reflexes to stop their fall, a falling infant experiences a head-first impact followed by neck hyperextension from the force of the trailing body mass. The resultant upper spinal cord injury can occur without detectable spinal cord injury on x-ray or CT. Thereafter, the infant's respiratory centre at the cervico-medullary junction is compromised which leads to hypoxic (loss of oxygen) brain injury, including the commonly seen thin film SDH. CT often shows the brain injury, but only MRI imaging may show the additional neck or spinal cord injury. Barnes and his group[325] have used MRI to document the absence of neck findings with alleged shaking cases and reiterated the expectation of neck pathology with a substantial shaking mechanism, including soft tissue injury, ligament damage, fractures and, in extreme cases, decapitation. Bandak, in a study of projected neck damage from abusive shaking concluded:

> *We have determined that an infant head subjected to the levels of rotational velocity and acceleration called for in the SBS literature, would experience forces on the infant neck far exceeding the limits for structural failure of the cervical spine. Furthermore, shaking cervical spine injury can occur at much lower levels of head velocity and acceleration than those reported for the SBS.*[326]

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[323] Ibid n 322, Bandak.
[324] Ibid n 322, Barnes et al.
[325] Barnes, P.D, 'Imaging of Non-accidental injury (NAI) and the Mimics: Issues and Controversies in the era of Evidence-based medicine' (2011) 49 *Radiological Clinics of North America* 205-229.
[326] Ibid n 322, Bandak, 71.

Biomechanical testing with instrumented mannequins have demonstrated that humans can generate only 10 – 15 G of acceleration of the brain with the most forceful shaking, a fraction of that generated by Ommaya (600 G), and below the threshold for the National Highway Traffic Safety Administration data which indicates that known injury thresholds to the brain are in the 80 - 100 G range.[327] Above 100 G, injury to the brain can be expected and below 50 G, no injury occurs.[328] Gabaeff concluded in his review that the force required to impact on the neck and cause intracranial injury, in the absence of evidence of neck injury on imaging studies, is unlikely to be caused by human shaking of a previously healthy child and shaking should not be considered as a cause of such findings.[329]

In summary, biomechanical studies have yet to establish the force required to produce the SDH and RH. The current research does indicate that: (1) shaking may produce indirect brain injury if there is also neck and cervical spine injury, rather than direct injury, as suggested by Guthkelch and Caffey; (2) angular acceleration/deceleration injury forces occur with impact trauma; (3) accidental injury does not require the force associated with motor vehicle accident or multi-story fall, as smaller heights can cause brain injury if there are rotational forces on the brain; (4) household or short-distance falls can produce direct or indirect brain injury; (5) as well as fall height, impact surface and type of landing are important factors; (6) head-first impacts in infants who have not developed reflexes, such as putting out their arm to break the fall, are the most dangerous and may cause direct or indirect brain injury (e.g.

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[327]Klinich, K, Hulbert, G, and Schneider, L, 'Estimating infant head injury criteria and impact response using crash reconstruction and finite element modelling' (2002) 42 *Stapp Car Crash Journal* 165-94.
[328] Ibid n 317.
[329] Gabaeff, S.C, 'Challenging the Pathophysiologic connection between Subdural Haematoma, Retinal Haemorrhage, and Shaken Baby Syndrome' (2011) 12 *Western Journal of Medicine* 144-158.

undetected spinal cord injury).[330] Caffey and child abuse specialists assumed that short falls did not produce the force necessary to cause injury, which may generally be true, but short falls have been associated with injury, albeit in rare instances.[331] There has been recent acknowledgement in child abuse literature that short falls can cause SDH, as well as RH and other retinal damage.[332] Therefore, biomechanical studies suggest that SDH and RH can occur in non-abuse situations, such as accidental injuries.

4.6 Retinal haemorrhages

Controversy surrounds the specificity of RH to shaking injuries. Some researchers and clinicians argue that RHs are the result of non-accidental head injury and pathognomic of SBS, especially when observed in conjunction with perimacular[333] retinal folds,[334] that is, in the multiple layers of the retina. It has also been asserted that RHs of a particular pattern are diagnostic of SBS. However, RHs are more common than these assertions suggest and are not always associated with assumed shaking.[335] RH from compressive labour forces alone, leading to raised intracranial pressure, occurs in 46% of all births. As RH was documented in non–abuse cases, the criteria to diagnose shaking was changed so that only the more severe forms of intraocular haemorrhage were to be

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[330] Ibid n 329; Ibid n 322, Barnes et al.
[331] Ibid n 302.
[332] Goldsmith, W, and Plunkett, J, 'A Biomechanical Analysis of the Causes of Traumatic Brain Injury in Infants and Children' (2004) 25 *The American Journal of Forensic Medicine and Pathology* 89-100. Obi, E, and Watts, P, 'Are there any pathognomonic signs in shaken baby syndrome?' (2007) 11 *Journal of American Association for Pediatric Ophthalmology & Strabismus* 99-100.
[333] The macula is a yellow highly pigmented spot in the center of the retina.
[334] Ibid n 256, Emerson et al; Office of Juvenile Justice and Delinquency Prevention (OJJDP) *Recognizing when a child's injury or illness is caused by abuse: Portable guides to investigating child abuse.* (Washington, D.C.: U.S. Department of Justice, Office of Justice Programs, 1996).
[335] Lantz, P. E, Sinal, S. H, Stanton, C. A, and Weaver, R.G, 'Perimacular retinal folds from childhood head trauma' (2004) 328(7442) *British Medical Journal* 754-756.

considered diagnostic of non-accidental head injury. Gilliland[336] and Emerson [337] have documented the invalidity of relying on any 'pattern' of RH as diagnostic of abuse. Emerson concluded that in 118 cases of suspected abuse, the variety of findings did not fit any particular pattern and were distributed almost equally among blunt head injury and blunt injury to the body (52% vs. 40%). Lantz[338] examined autopsy results on 425 eyes and found 17% had RHs associated with a variety of diseases and conditions, thereby questioning the reliability of using quantity, location or pattern of RH to diagnose abuse, when extensive RH is found reliably in a variety of conditions associated with extreme intracranial pressure, protracted hypoxemia (inadequate oxygenation of blood) or other conditions.

Apart from birth injuries, RH has been found in coagulation disorders, osteogenesis imperfecta (condition causing extremely fragile bones), near or fatal suffocation, straining, repeated and forceful sneezing, and, very occasionally, after resuscitation.[339] Furthermore, 6% of children who were physically abused, but not by shaking, developed ocular signs, including RH. These findings suggest that RH occurs in a variety of unpredictable circumstances, is not homogenous in origin and not specific to SBS. At best, RH should raise concern about abuse but is not definitive proof of inflicted injury.

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[336] Gilliland, M.G, and Luthert, P, 'Why do histology on retinal haemorrhages in suspected non-accidental injury?' (2003) 43 *Histopathology* 592 – 602.
[337] Emerson, M, Jakobs, E, and Green, R. 'Ocular Autopsy and Histopathologic Features of Child Abuse' (2007) 114 *Ophthalmology* 1384-94.
[338] Ibid n 335.
[339] Goetting, M. G, and Sowa, B, 'Retinal hemorrhage after cardiopulmonary resuscitation in children: An etiologic re-evaluation' (1990) 85(4) *Pediatrics* 585-588.

Similarly, studies examining the association between velocity (accelerations) and RH have shown that high accelerations do not cause RH.[340] Animal experiments generating extreme accelerations to the eye without impact at around 1000 G have also failed to produce any RH.[341] These accelerations are 70 – 100 times greater than those that can be generated by humans through a shaking mechanism. In his review of forensic and medical literature, Gabaeff found no instances of videotaped or witnessed shaking of previously healthy infants with immediate SDH and RH.[342] However, when shaking episodes have been recorded, no associated SBS injury markers have been observed. Gabaeff concluded that RH is not caused by shaking alone or in pure high G situations. This is consistent with biomechanical studies indicating that shaking alone is insufficient to cause SDH or RH.

At present, research does not support an unquestioning belief in RH as being specific to SBS. RH is a complex phenomenon and there is no agreement about the presentation of RH (in terms of number, size, site) needed to decide unequivocally that SBS has occurred.

4.7 Analysis and conclusions

The empirical challenge to establishing the accuracy of shaking as the cause of the triad, alone, is considerable. The presence of the triad in young children, who have not been in a motor vehicle accident or substantial fall, is attributed to SBS. The belief that the

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[340] Funk, J.R, Duma, S.M, Manoogian, S.J, and Rowson, S, 'Biomechanical risk estimates for mild traumatic brain injury' (2007) 51 *Annual Proceedings of the Association of for the Advancement of Automotive Medicine* 343 -361.
[341] Raghupathi, R, and Margulies, S.S, 'Traumatic axonal injury after closed head in the neonatal pig' (2002) 19 *Journal of Neurotrauma* 843-5; Binenbaum, G.L, Forbes, B.J, Raghupathi, R, Judkins, A, Rorke, L, and Margulies, S.S, 'An animal model to study retinal haemorrhages in nonimpact brain injury' (2007) 11 *Journal of American Association of Pediatric Ophthalmology and Strabismus* 84-85.
[342] Ibid n 341, 146.

triad is non-accidental in cause and develops immediately after an infant has been shaken violently means that the adult with the victim is seen as the obvious perpetrator. There is a fundamental circularity in reasoning with regard to medical decision-making when determining whether a death constitutes homicide. The signs which define SBS or raise suspicion of SBS are also the means for verifying the child has been abused. The signs are used to infer that intentional injury has been perpetrated, based on the presenting signs.

Assumed SBS cases can have a range of findings from obvious head trauma (such as skull fracture) to subtle signs, which are not evident on external examination. The current medical knowledge base on SBS and the triad is vast, complex and contradictory. There are opposing factions, in effect, in the medical community, with proponents of shaking as the causal mechanism preceding the triad asserting that scientific research and case studies spanning decades, countries, and medical specialties strongly supports the view that abusive trauma leads to the triad. Those advocating caution, better understanding of the reliability of diagnosis of the cause of the triad and improved research, raise serious doubts about the accuracy of shaking as the aetiology of the triad. These voices in the medical community do not deny the potential for shaking to explain the triad, but do question the evidentiary reliability of SBS as the *only* cause of the triad.[343] Research reports indicate that the triad can occur in accidental injury (such as, witnessed short-distance falls and re-haemorrhages from birth-related trauma), as well as in other medical conditions, even if rarely so. Medical conditions that can resemble SBS include hypoxia-ischemia (oxygen loss from restriction of blood supply)

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[343] Ibid n 49, Donohoe; Ibid n 246, Leestma; Ibid n 247, Lyons; Ibid n 247, Gena; Ibid n 13, Goudge; Mackey, M, 'After the court of appeal: R v Harris and others [2005] EWCA Crim 1980' (2006) 91 *Archives of Diseases in Childhood* 873-5; Ibid n 264, Squier.

caused by apnoea (suspension of external breathing), choking, or respiratory or cardiac arrest, ischemic injury (arterial vs. venous occlusive disease), vascular anomalies, seizures, infectious or post-infectious conditions, coagulopathies (bleeding disorder from blood clotting problems), fluid-electrolyte derangement, and metabolic or connective tissue disorders, including vitamin deficiencies and depletions.[344] There is by no means consensus in the medical community about the cause of the triad; rather a sharp division exists in which some physicians claim the cause of the triad is well established, while others are more cautious and cognisant of the limitations of medical understanding of the triad. This is a fact that should be made clear to criminal courts when medical experts provide opinion evidence in cases of triad deaths.

As with SIDS research, there are significant and pervasive methodological flaws in SBS research. There are several sources of error that potentially affect the accuracy of the conclusions drawn from the data. The first is whether shaking is an accurate cause of the triad. Several reviews of the current medical evidence were discussed, the most support for the SBS hypothesis coming from Narang. He argued that research in clinical medicine, such as infant death determination, is unlikely to be in the form of randomised controlled research designs favoured by the growing evidence-based medicine movement due to design and ethical constraints in conducting SUDI research. Consequently, SUDI research should not be held to a standard that is unachievable. However, Narang seems to substitute methodological rigour with the relatively more subjective process of clinical judgment, particularly the judgment of child abuse paediatricians. Given increasing concerns that the area of child abuse has escaped critical scrutiny, it is troubling that clinicians such as Narang are not more willing to develop

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[344] Ibid n 322, Barnes et al.

clinical judgment along the lines of evidence-based medicine, which would make the clinical reasoning process more transparent and defensible.

The second issue relates to research design and quantitative measurement of SBS and its assumed indicators. Narang overstates the meaning of statistical significance between correlated variables as proof that shaking causes the triad. Establishing that certain variables (such as, the triad and assumed shaking) co-exist to a statistically significant level does not prove that the two are causally related. In emphasising statistical significance as proof of shaking, Narang overlooks the fundamental question: is there a causal association between the triad (or specifically, SDH and RH) and shaking? Without attention to base rates, accurate case ascertainment and independent corroboration of SBS, it is difficult to gauge the meaning of correlations between signs and SBS. Any descriptive or case series design does not answer causal questions or prove that shaking causes the triad, nor does it advance an understanding of the meaning of correlations.

The third, and perhaps most fundamental, issue in SBS research is that there is no independent verification or validation of shaking as the mechanism leading to the triad. It is *assumed* that the triad is caused by shaking based on the original theory proposed by Caffey and occasional confessions, notwithstanding their inherent problems. The triad – or specifically SDH and/or RH – can occur under a wide variety of circumstances, from witnessed short-distance falls to re-bleeding from birth-related trauma as well as in other medical conditions.[345] Evidence that these signs are observed in non-SBS contexts, raise doubt about whether these haemorrhages discriminate between SBS and other causes. If it is not possible to distinguish between SBS and other

[345] Ibid n 322, Barnes et al.

mechanisms leading to the triad, subdural and retinal haemorrhages have limited value in detecting SBS. The findings of SBS-type signs in non-abuse situations suggests that great caution is necessary, as the notion that the triad is indicative of SBS is not readily supported by the empirical literature.

Researchers have also conflated the assumed cause of the triad with proof of cause. This means that studies referring to cohorts of putative shaken babies are assuming they were shaken without independent verification that this is the case. Consequently, correlations between shaking and the triad have an uncertain meaning because we cannot be sure the infants classified as shaken were, in fact, shaken.

There are psychological factors in expert judgment that complicate matters further. Reconstructing events preceding injuries without independent verification of these events is inevitably open to hindsight bias,[346] as a catastrophic event has occurred, and error,[347] and the accuracy of the reconstructed events is unknown. Irrespective of the quality of research design or case analysis and the level of statistical significance achieved, the absence of independent verification means conclusions about the cause of the triad remains unreliable and uncertain. The medical community needs to actively question its knowledge base and attempt to improve the reliability of its opinions, if it is to be effective in protecting infants and preventing wrongful convictions.

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[346] See Chapter 7 for discussion of psychological factors underlying medical judgment. Biases are unconscious psychological processes that impact on experts' interpretation of case facts by making arguably ubiquitous or irrelevant events seem inculpatory. These biases can transform equivocal medical and psychosocial evidence into certain proof of homicide, if the expert is unaware of the influence of such psychological processes in their reasoning and decision-making. This constitutes another source of unreliability beyond that associated with poor research design or unjustified interpretation of research or clinical experiences as proof of homicide.

[347] See especially Chapter 7, sub-section 7.5 for an examination of the psychological factors that affect acquisition of expertise. Developing expertise depends on ongoing feedback that the expert's judgment and decision-making is accurate. The difficulty in independently validating medical opinion that an infant death constitutes homicide affects the reliability of this type of evidence and should be disclosed to the Court. It is proposed that an uncritical stance has led some experts to overestimate the accuracy of their judgments so that suspicion of homicide has become confirmation.

The SBS diagnosis is essentially a hypothesis that requires more research and inquiry to determine the cause of injury and death. Determining whether shaking causes the triad requires detailed prospective studies in which all infants born in several hospitals are followed across time on variables relevant to understanding the triad, such as the incidence of birth-related or other haemorrhages preceding the alleged shaking. Such a study would provide a better understanding of the 'base rate' or population prevalence of the triad and other physical characteristics of infancy, instead of the commonly used descriptive case studies that do not address the prevalence issue. This would assist in deciding whether observed SDH or RH is unusual in an infant of the deceased infant's age and birth and medical history, a fact that is required to ascertain whether other, including inflicted, mechanisms of injury should be considered. In addition, it is important to apply the same empirical rules to hypotheses that support and those that refute SBS. The 'hypothesis' or theoretical debate in SUDI research reveals a central problem in medicine and medical opinion evidence in court. It is the longstanding tension between scientific modes of proof and knowledge gained by clinicians from practice. This is a significant and unresolved tension, which requires attention from the medical community to develop better methods for understanding and representing their knowledge in clinical and forensic settings. As the law depends so heavily on expert testimony, courts require guidance from the medical community in differentiating between high quality research and clinical opinion evidence, and speculation based on subjective clinical experience and belief.

Bearing in mind these methodological limitations, if researchers, reviewers and clinicians were mindful of the constraints of the typical SBS research designs (imposed understandably by ethical limitations of more controlled scientific research), it is reasonable to conclude that the triad *is* consistently more prevalent in cases of alleged

shaking trauma. That is, the research does indicate a higher *frequency* of triad injuries in assumed shaken baby cases. However, without accurate estimates of base rates, the meaning of higher correlations is unclear. Without independent corroboration it is unknown whether cases are being correctly classified as homicide. The *cause* of the triad is also an unresolved question, as correlational studies do not advance this question.

Research suggests that the period of lucid interval after sustaining injuries is unknown, so it is not a forgone conclusion that the person in whose care the child died was the perpetrator of the assumed shaking trauma. The likelihood of correctly identifying abusive trauma is greater when there are external signs of injury particularly because shaking is now considered to involve insufficient force to cause the triad. Despite this, SBS advocates continue to assert that the triad is the result of violent shaking with or without slamming and rotational and acceleration-deceleration forces on the brain (the 'accepted' hypothesis). This position has been seriously challenged by Geddes' research, which suggests that reduced oxygenated blood to the brain, from any cause, explains the autopsy findings of thin film bleeds, contrary to the SBS position that bridging veins are torn. From an anatomical perspective, the haemorrhages from putative venous shearing (thought to result from acceleration/deceleration forces after shaking) should produce large collections of blood evident on macroscopic examination. However, this type of bleeding is rare in assumed shaking cases. Geddes' findings have been the subject of intense medical and legal debate, especially Geddes III, which contends microscopic findings in natural deaths and alleged SBS cases might reflect a cascade of events, including raised blood pressure in the brain, immaturity and loss of oxygenated blood supply to the brain, rather than shaking. SBS advocates stridently resist this hypothesis without offering a viable alternative, other than reiterating that the triad is indicative of shaking death. It is noteworthy that Geddes, a neuropathologist, has

approached death investigation from an anatomical viewpoint, which has taken debate about inflicted injury deaths from the seemingly closed domain of child abuse paediatrics with its associated reliance on clinical judgment to alternative physiological investigations. This can only serve to improve child protection and death inquiries. Reliably proving how an infant died rests on transparent and critical analysis of medical knowledge of sudden infant death.

Biochemical research also does not support the assertion that shaking alone is sufficient to cause the triad. The degree of force and velocity required to cause the triad should, according to biomechanical studies, cause neck injuries as well as affecting the brain. Extrapolating from these animal studies, human infants with a larger and heavier head to neck ratio, would be expected to sustain neck injuries as the head swings from back to front. However, neck injuries have not been prevalent in cases of alleged SBS.[348] The whiplash motion originally suggested by Caffey should coincide with cervical-neck trauma, yet it does not, which raises doubts about shaking as the cause of the triad.

Advocates of shaking as the cause of the triad seem to have an uncritical view of the research evidence to date. The violence predicted from biomechanical studies is used by SBS advocates to refute the hypothesis that shortfalls can lead to the triad, as there is insufficient force. Yet the same experts reject biomechanical studies on the basis that the infant human brain cannot be simulated accurately with anatomical models. This suggests that shaking proponents have a confirmatory bias in their reasoning, which results in selectively processing research findings to conform to their theory. Turkenheimer[349] argues that SBS as the cause of the triad was sustainable when medical

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[348] Ibid n 329, 146.
[349] See generally Ibid n 247, Tuerkheimer.

discourse was contained to child protection. However, in the late 1990s, researchers looked beyond child abuse to pathologists, biomechanical engineers and neurosurgeons. Knowledge from these disciplines challenged the pathognomic relationship posited between shaking and the triad. Conceivably these endeavours are beginning to provide a more nuanced perspective of SBS and the triad.

The carer's inability to provide a sufficient historical explanation is held as inculpatory evidence against the accused. This approach unduly shifts the burden of proof to the defendant to establish innocence by proving the expert theory wrong. The lack of evidence or acceptable historical explanation for a medical condition does not suggest, by default, that the injuries were caused by abuse. This stance also implies that medical experts *know* the cause of the triad so that inconsistent explanations are identifiable, which is overstating the certainty of current medical knowledge on the triad.

Further research that systematically documents the conditions in which the triad is found across the infant population is needed. This type of information will help to understand individual differences in physiology, disease states, response to trauma, and recovery or death. It is under these conditions that relatively more reliable inferences can be made about the meaning of the triad and potential wrongful convictions can be avoided.

It is not being asserted that the triad is *not* caused by abuse. Rather, the empirical or independently verifiable basis for SBS is lacking. In essence, the SBS dilemma has seen a heightening of a centuries-long tension between medical knowledge gained from practical, percipient clinical experience and that gained from empirical, experimental studies. Should intuition be trusted over well-designed research in clinical medicine? The argument seems to be that the ethical constraints on research are the justification for relying on medical opinion, irrespective of concerns about the reliability

and accuracy derivative opinion. This approach is potentially misleading, whether the medical evidence is for the purpose of child protection or use in criminal trials.

Chapter 5: Shaken Baby Syndrome (SBS): Appellate cases

This chapter describes appellate cases involving sudden unexplained infant deaths due to presumed shaking or fatal head trauma. These cases are different to smothering/SIDS cases as there are positive signs or findings – the triad of retinal and subdural haemorrhages and encephalopathy – but there is ongoing disagreement within the medical community about the *cause* of the triad. The previous chapter concluded that medical opinion evidence about the cause of the triad is limited by problems in accurately determining if the triad is actually caused by shaking. Medical testimony in court, therefore, ought to reflect the indeterminate state of medical understanding of triad injuries, and in turn, the limitations of medicine to provide an unequivocal answer about mechanisms of death in triad cases. The following examined appellate cases demonstrate that experts' testimony has not reflected the genuine limitations in determining how the triad occurs. Rather, experts have confidently testified that the triad is tantamount to proof of shaking, which means the death constitutes homicide. Lower courts were exposed to conflicting expert evidence, with juries having to resolve evidence from a vast array of experts. The judgments below reveal that judicial instructions have also failed to properly instruct juries about resolving conflicting expert testimony in triad cases. These appeals constitute failures by both medical and legal communities to address reliability of medical opinion evidence, which is critical to achieving a fair trial.

Judges in the common law countries, in which appeals have occurred, do not always attend to questions of reliability of medical opinion evidence at pre-trial hearings. Unsurprisingly, the appeals reflect limited interest – and possibly ability – in assessing the reliability or accuracy of medical opinion, beyond factors such as credentials, acceptance within the expert community and type of expert experience. Clinical

experience is often preferred to research experience and published research, especially when there is conflicting expert opinion from seemingly equally qualified experts. Experts have conveyed a view of current clinical and research knowledge aligned with their own views about cause of sudden infant death (SUDI), erroneously implying a consensus of opinion that does not exist. Notwithstanding professional and statutory obligations in many jurisdictions,[350] experts have relied on their own experience – or subjective, untested beliefs – to justify opinions based on relatively flimsy evidence. Medical opinion evidence in SUDI cases is generally clinical in nature, which is valuable in decision-making but is vulnerable to biases, which in turn can affect its reliability and therefore its probative value in criminal trials.

In England and Wales, after Cannings' conviction was quashed, the Attorney General and Director of Public Prosecutions reviewed all cases in which a parent or carer had been convicted of killing a child under 2 years.[351] This covered a 10-year period and involved a review of 297 infant death cases. The review identified 97 cases in which death was thought to be from shaking. The Attorney General directed these cases to be reviewed separately from apparent smothering cases. In 2005, the Court of Appeal of England and Wales (EWCA) heard four cases together in *Harris, Rock, Cherry and Faulder.*[352] Harris and Cherry were invited to appeal their conviction at the Court of Appeal, the Criminal Cases Review Commission referred Faulder for review, and Rock had already lodged an appeal. Similarly, in 2010, the EWCA also heard appeals from *Henderson*, *Butler*, and *Oyediran*.[353] Henderson and Oyediran argued that they had not

[350] See Chapter 9, sub-section 9.1.7 for discussion of expert witness code of ethics.
[351] Lord Goldsmith, *The Review of Infant Death Cases.* (London, Attorney General's Chambers, 2005).
[352] Ibid n 8, *Harris*.
[353] Ibid n 8, *Henderson*.

harmed the deceased infant. Henderson's appeal addressed unchallenged medical evidence from the trial while Oyediran maintained his assertion the medical evidence did not prove he had killed his son. In Butler's case, his daughter recovered from her injuries, which significantly altered medical opinion on the cause of the injuries.

5.1 R v Harris, Rock, Cherry & Faulder[354]

Harris and *Ors* appealed convictions for infant homicide based on medical opinion evidence that the injuries and death were caused by shaking. Each appeal was separately determined due to differences in case facts. However, the common feature was the deceased or injured infant was in the sole care of the convicted adult. The appellants argued developments in medical research challenged the safety of their convictions. The cases will be discussed separately after reviewing the common medical issues considered in the appeals.

The central medical issue was the meaning of the triad and its cause, and the relevance of research from Geddes (dubbed I, II and III).[355] Geddes I and II were met with approval by the court and medical experts, as both were 'largely accepted by the scientific community'.[356] Both studies documented autopsy findings without attributing a cause for the triad or the degree of force required. Geddes III (unified hypothesis),[357] however, was controversial. Geddes III suggested an alternative mechanism of injury to the accepted – Caffey's original – shaking hypothesis. Geddes proposed the triad was not diagnostic of the actual mechanism of death. Geddes argued triad signs can also be caused by lack of oxygen, infection or raised intracranial pressure, instead of direct

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[354] Ibid n 8, *Harris*.
[355] See Chapter 4 for in-depth discussion of SBS; Ibid n 293, Geddes, Hackshaw et al; Ibid n 295, Geddes, Vowles et al; Ibid n 295 Geddes, Tasker et al.
[356] Ibid n 8, *Harris*, 256.
[357] Ibid n 301.

trauma to the brain. She did not say her proposed mechanism was *not* non-accidental in nature, only that the presence of the triad did not explain *how* it occurred. In *Harris*,[358] Dr Geddes conceded the unified hypothesis was based on incomplete research and should not be taken as fact, but neither should a shaking hypothesis. Geddes' testimony emphasised what is perhaps a truism in scientific inquiry: that is, medical knowledge consists of hypotheses with varying degrees of empirical support at any given time. Consequently, shaking, as a cause of the triad was as much a hypothesis as was her proposed mechanism. The Court distinguished between fact and hypothesis, suggesting a lack of understanding that scientific process is iterative. The Court held that Geddes III poses unsolved questions:

> *...the unified hypothesis can no longer be regarded as a credible or alternative cause of the triad of injuries.*[359]

Harris and Ors also relied on a report provided by Dr Thibault, a biomechanical engineer specialising in paediatric head injury mechanics,[360] who, using anatomical replications of the human brain, had investigated the threshold at which physical force causes damage to the infant skull and brain. Thibault testified that studies with adults and experimental and real-life accident analysis shows intracranial pathology results from angular deceleration of the head. Thibault argued that movement between the skull and brain could cause strain within the neural and vascular tissue. He highlighted the unique effects of acceleration-deceleration forces on the infant skull, which becomes deformed, thereby causing injuries inside the skull and its tissue. Thibault agreed that

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[358] Ibid n 8, *Harris*, 58.
[359] Ibid n 8, *Harris*, 69.
[360] Ibid n 8, *Harris*, 89.

short falls could cause severe injury though rarely. He described medical experts' comparing the injury mechanism being tantamount to falls from two-story buildings or high-speed vehicle accidents as 'arbitrary, unscientific and meaningless',[361] as many variables determine the amount of force and movement needed to cause injury in an individual infant. The appellants argued shaking alone could not produce the damage seen in these infants and, if the infants had been violently shaken to the extent required to produce the injuries, there would have been associated spinal and neck injuries, which were not found. A Crown expert in Cherry's case, Dr Bertocci, gave evidence based on her research that short-distance falls rarely lead to diffuse axonal injury (nerve damage). The Court also examined the meaning of retinal haemorrhages (RH), with experts debating the necessity of this sign in diagnosing shaking, the role of a rapid rise in intracranial pressure, and whether RH from shaking can be distinguished from other causes of RH. The Crown submitted the fundamental question in the appeals was the degree of force necessary to cause the triad.[362]

5.2 Lorraine Harris

On 7 September 2000, Lorraine Harris was convicted for the manslaughter of her son, Patrick Maguire, aged 4 months, and sentenced to three years imprisonment. Patrick was Harris' only child with Sean Maguire. She had two children from a previous relationship living with her and Maguire. Although unplanned, the couple were happy about Patrick's birth and he was a healthy, thriving baby. There were no discernible stresses and the family was thought to be functioning well. Patrick appeared well after his third

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[361] Ibid n 8, *Harris*, 92.
[362] This is a critical issue in triad deaths; See also *R v Klamo* [2008] VSCA 75.

immunisation on 4 December. That night, while Maguire was at work, Harris found Patrick having difficulty breathing. Their medical practitioner examined Patrick at home and left at 1.30 a.m. without finding anything of concern. Harris called emergency services at 2.34 a.m. as Patrick would not wake up. Paramedics attempted to resuscitate Patrick, who was warm but not breathing. Harris was 'plainly in distress and crying".[363] Patrick was placed on a life support machine in hospital. He had retinal and subdural haemorrhages and was transferred to a specialist paediatric unit but died on 6 December. Blood tests revealed marked hypofibrinogenemia (a deficiency of fibrinogen, a blood clotting factor).

The pathologist conducting the post-mortem examination attributed the death to shaking. In March 2000, Harris was charged with manslaughter. A forensic pathologist, Professor Green, gave evidence there were extensive retinal haemorrhages, which he attributed to shaking or shaking and impact. A consultant haematologist, Dr Giangrande, attributed Patrick's low fibrinogen to the fatal injury but could not exclude the possibility the condition predated the injuries. A paediatric neurosurgeon, Mr Punt, stated death was due to brain injury from being shaken or impact or both and the actions leading to death occurred after the family doctor left the home at 1.30 am. He also dismissed bleeding disorder as a possible mechanism of death.

Harris gave evidence in her trial and was consistent in her account of the events preceding Patrick's admission to hospital. She was unable to explain the cause of his injuries. Medical experts were called for the defence. Dr Batman, a histopathologist, attributed the death to a blood disorder or shaking with or without impact. Dr Jones, a paediatrician concluded the death was due to a blood disorder, although he agreed the

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[363] Ibid n 8, *Harris*, 11.

death could be consistent with shaking and he had not seen a death from fibrinogen deficiency. Lastly, a neuropathologist, Dr Macdonald, ruled out non-accidental injury while conceding the extent of retinal haemorrhages was consistent with severe shaking, except for the absence of bleeding in one eye. The jury found Harris guilty after deliberating for three hours.

The Crown and the appellant called several medical experts in the appeal. The experts disagreed about the triad, its cause and whether Harris' explanation conformed to opinion about the mechanism of death. Crown experts tended to support the shaking hypothesis, while defence experts proposed other physiological mechanisms preceding the triad and death. The Court judged the Crown's case that the triad was caused by shaking as strong but it did not unequivocally discount Harris' submissions. The Court held the verdict was unsafe given medical developments after the trial: that is, doubts about the nature and extent of subdural haemorrhages; retinal haemorrhages alone were not diagnostic of shaking; catastrophic injuries can, on rare occasions, result from low level forces; and recent attenuation of medical opinion that shaking causes the triad. The Court emphasised Harris' good character, her concern for Patrick in calling the doctor during the night, and the absence of bruising, fracture, or other injuries anywhere else in the body. The Court held that the triad 'stands alone'[364] may be of uncertain reliability in this case and is not alone diagnostic of SBS. The Court quashed the conviction as unsafe.

Overall, in *Harris*, the Court held that there was no scientific means of determining the amount of force required to cause the triad, although the force seems to be less than originally thought, and, on rare occasions, minor falls could cause the

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[364] Ibid n 8, *Harris*, 152.

triad.[365] The Court stressed the responsibility of the expert witness to 'never assume the role of an advocate'.[366] Ultimately, the Court held that its function was to determine the safety of the convictions, based on the evidence before the jury, but differences in medical opinion about the triad was for the medical community to resolve. The critical question then for the Court was whether the triad *alone* was diagnostic of shaking, finding:

> *...the mere presence of the 'triad' does not automatically or necessarily lead to a diagnosis of NAHI[367] and/or a conclusion of unlawful killing. All the facts of the individual case must be taken into account.[368]*

Moreover, the Court held that each case is to be decided on its own facts, particularly those relating to the clinical history, including the carer's account of events, which should not be discounted:

> *The clinical history is perhaps the most important tool available to the clinician and to reject the carer's version of events in favour of another requires the highest possible level of medical evidence. After all, the Doctor is effectively accusing the carer of lying.[369]*

5.3 Charles Rock

Charles Rock was convicted on 21 September 1999 for the murder of his partner's daughter, Heidi Smith, aged 13 months and sentenced to life imprisonment. Heidi was born on 10 May 1997 to Lisa Hudson and James Smith. In March 1998, Hudson separated from Smith and moved in with Rock. Rock's two children from a previous

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[365] Ibid n 8, *Harris*, 148.
[366] Ibid n 8, *Harris*, 271.
[367] Shaken Baby Syndrome.
[368] Ibid n 8, *Harris*, 175.
[369] Ibid n 8, *Harris*, 149.

marriage lived with their mother. Heidi was described as a healthy, settled baby and Rock doted on her. However, Hudson reported Rock had a bad temper and when Heidi was unsettled, Rock held her face and told her to 'shut up'. On 2 June 1998, Hudson was at work. Her mother put Heidi in her cot at 6.35 pm before leaving, at which time Heidi was asleep and breathing normally. Hudson was unable to reach Rock after 7 pm. A neighbour heard an infant screaming and someone shouting for the infant to shut up and, at approximately 7.20 pm, the screaming stopped. Rock gave evidence he had said 'shut up' but as part of a longer sentence 'you heard your mum; you've got to shut up".[370] He stated that Heidi awoke from sleep crying loudly and he found her red-faced in her cot and very upset. He then held Heidi and rocked her, as he tried to activate her mobile. At this point, Heidi slipped from his arms and fell on her bottom onto the floor. She did not bang her head but continued to cry. When he picked her up, Heidi was not breathing. Rock held her in front of him without shaking her. He placed her on the floor and attempted resuscitation. On the fourth attempt, Heidi vomited. Rock held her over the sink and banged her back to help her vomit, which he said she did. He called emergency services, which arrived 10 minutes later. At the hospital, Heidi was transferred to the Intensive Care Unit with spasmodic seizures and she was breathing but unconscious. Heidi had massive haemorrhages on all layers of the retina, attributed by an ophthalmic surgeon to severe acceleration and deceleration forces. A neuroradiologist, Dr Jaspan, found cerebral haemorrhages considered consistent with trauma. The specialist concluded that Heidi had suffered profound and irreversible damage to blood vessels, which would have rendered her immediately unconscious. He disagreed that falling on her bottom would have caused such severe injuries; rather it was characteristic of violent

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[370] Ibid n 8, *Harris*, 20.

shaking. Mr Punt, the same paediatric neurosurgeon who had been consulted in the Harris case, agreed with Dr Jaspan that the CT scan showed injuries that were caused by violence that was 'extreme, grossly in excess of any vigorous handling'.[371]

The post-mortem examination was conducted on the day Heidi's life support system was turned off. Dr Cary, a pathologist, found superficial bruising on the body and within the scalp and bleeding around the optic nerve. He found the brain was swollen and there was bleeding on the brain surface but no skull fracture. He concluded the bilateral retinal detachment and head injuries were consistent with shaking. He concluded Heidi was shaken violently and several times on the basis of retinal damage. Professor Green, a forensic pathologist, confirmed this opinion. Lastly, Dr Smith, a neuropathologist, confirmed the brain injuries were consistent with trauma causing the brain to move within the skull. She excluded natural diseases and attributed the retinal haemorrhages to shaking.

Rock gave evidence in his own defence and denied shaking Heidi but accepted he knew the consequences of shaking a baby could be fatal. He maintained his account of dropping Heidi on her bottom. However, in cross-examination he conceded he had not told police that Heidi became floppy after he had shaken her because he felt guilty. The judge instructed the jury, on the strength of the Crown evidence, that Rock had severely shaken Heidi and had admitted he did so. He emphasised the injuries were not accidental and not guilty was not a realistic verdict in this case, although it was the jury's prerogative to come to its own decision. The jury returned a verdict of guilty after 40 minutes of deliberation.

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[371] Ibid n 8, *Harris*, 23.

Rock appealed on the basis that research after the trial cast doubts on the force required to injure an infant. The appeal further submitted that a verdict of murder was unsafe and a conviction of manslaughter should be substituted. The Court held that in Rock, unlike *Harris*, the triad did not stand alone, as, despite his good character, Rock had been hostile to Heidi and yelled at her, which a neighbour overheard. The Court reviewed the medical evidence, which was contradictory, as in *Harris*. However, the Court judged Rock's temper and inconsistent explanation for the events preceding the injuries, both psychosocial factors, rendered the verdict safe and the appeal was dismissed. The Court downgraded the conviction from murder to manslaughter, as the intention to harm Heidi was not upheld in the appeal.

5.4 Alan Cherry

Alan Cherry was convicted on 9 October 1995 for manslaughter of his partner Shirley Eburne-Day's daughter, Sarah, aged 21 months, and sentenced to two years imprisonment. Cherry lived with Eburne-Day and her two other children. Sarah was the youngest of Eburne-Day's three children. Sarah was in Cherry's sole care on 3 February 1994. Earlier in the week, Sarah had a thumb infection that was treated with antibiotics but the medication was changed as she experienced an adverse reaction. Eburne-Day had taken her other children and the neighbour's child, Lianne Osbourne, to school. Thereafter, Cherry and Eburne-Day planned to meet at Shirley's father's house so that Cherry could get ready to attend a job interview. Ms Osbourne later described Cherry as being formally dressed for the interview when she saw him. Cherry and Eburne-Day disagreed in their accounts of Sarah on the day: Cherry saying she was unwell, while Eburne-Day said she was not. At 8.55 am, Cherry was seen distressed and seeking help in the street. He called Eburne-Day's father and asked him to call an ambulance, which

he did. A neighbour who is a nurse said Sarah appeared to be dead or dying and attempted resuscitation until the ambulance arrived. Sarah was taken to the local hospital and later moved to an Intensive Therapy Unit, where she died 48 hours later.

Cherry was charged with causing grievous bodily harm with intent before Sarah died which was changed to murder after her death. In his police interview, Cherry stated he had left Sarah standing on a chair she liked to use to look out of a window at the front of the house, while he went to dress for the job interview. On return, Cherry said Sarah was lying motionless on the floor, making gurgling noises. She was floppy when he picked her up. Cherry thought she was ill and had fallen off the chair. He denied shaking or throwing her and stated that he was not guilty. Cherry knew she was injured but maintained that he had not hurt Sarah. The Crown proceeded with a charge of manslaughter.

The post-mortem was conducted by Dr Whitwell who concluded Sarah had died from cerebral swelling and subdural haematoma. She also found bruising on the back of the head and five small bruises higher on the head that she attributed to pressure from fingers. Whitwell said the injuries were consistent with Sarah's head banging against something. She did not believe the injuries were caused by a fall from the chair, although it was not impossible. Other medical witnesses for the Crown concurred with Whitwell that the bleeding and bruising observed were unlikely to be caused by a fall. The treating paediatrician in hospital, Dr Rylance, initially stated that the cerebral bleeding was 12 to 36 hours old, but later changed this estimate to 10½ to 11 hours. His view was the injuries were non-accidental in nature.

The defence experts were a neurologist, Dr West and a pathologist, Dr Ackland. West testified the scans taken by Dr Whitfield indicated Sarah had aspirated (inhaled) liquids, a common complication of head injuries. Dr Ackland did not rule out abuse but

did view an accidental fall from the chair as a significant possibility. He also concluded the bruises may have been incurred during medical treatment.

The trial judge's summary stated Sarah died from brain swelling caused by impact and it was for the jury to decide whether Cherry had inflicted the fatal blows. The jury returned a guilty verdict for manslaughter after deliberating for two and half hours.

Cherry's appeal rested on evidence since the trial indicating that low level falls can cause death and was the reason for the bruising on Sarah's head and body. However, the Court held that there was no evidence submitted to it of a 21 month-old child dying from a fall of 6 – 8 inches, as Cherry's counsel argued, despite advances in medicine showing, in some cases, short-distance falls can have serious consequences. The Court was unconvinced by Cherry's submission that the two sites of bruising could only be explained by two impacts to the head, bearing in mind that one set of bruises involved five small bruises (presumed to be caused by fingers), rather than two bruises in total. The Court dismissed the appeal.

5.5 Michael Faulder

Michael Faulder was convicted on 28 April 1999 for inflicting grievous bodily harm against his son, N,[372] aged 7 weeks and was sentenced to 30 months imprisonment. N was born two weeks prematurely. N was admitted to hospital on 13 February 1998 with severe injuries. He was transferred to a specialist unit as his condition deteriorated. However, N recovered and was discharged on 16 March 1998. Faulder was N's sole carer and his case was that the injuries were accidental as he dropped N when he arched

[372] Name suppressed on appeal transcript.

away from his hold and was injured in the fall. During the fall, Faulder asserted that N hit a pushchair and highchair before hitting the floor.

The Crown asserted Faulder had deliberately harmed N by shaking and throwing him to the floor. Three Crown medical witnesses testified N's injuries were inconsistent with a domestic fall and Faulder's description of N hitting chairs before landing on the floor would have broken, rather than exacerbated, the fall. N had bruises above the right eye and one on his head. Dr Alexander, paediatrician, said N's fontanel was unusually tense, indicating brain swelling due to brain damage and the CT scan showed bilateral subdural haemorrhages. He testified Faulder's explanation failed to explain the severity of the injuries, which were consistent with repeated, forceful shaking, rather than accidental mechanisms. Similarly, Mr Gholkar, a neuroradiologist, examined the brain scans and concluded N had severe brain damage characteristic of shaking injuries. There were no retinal haemorrhages, although there was disagreement between experts about the extent to which retinal haemorrhages were markers of shaking injuries.

Dr Rushton, a paediatric pathologist, gave evidence for Faulder. He testified that contact with chairs in N's fall could produce rotary forces that accelerated the head and increased the force of contact with the floor. He was unable to determine whether the injuries were due to shaking or single impact injury. Given the absence of retinal injuries and the fact that subdural haemorrhages can occur in the type of fall described by Faulder, Rushton could not rule out shaking or other mechanisms. The jury returned a guilty verdict after two hours of deliberation.

Faulder's appeal rested on two medical developments after the trial: Geddes' research that cast doubt on the mechanisms preceding N's injuries and a case in which

the prosecution expert witness, Dr San Lazaro, was strongly criticised.[373] Faulder sought to remove San Lazaro's evidence on credibility grounds. The appeal also relied on the MORO reflex (an automatic response seen in babies under age 8 weeks) to explain N's sudden movement out of Faulder's arms and subsequent fall. When the Criminal Cases Review Commission reviewed Faulder's case, the Commission questioned the Crown experts' view that N had a primary injury that would 'require massive and violent force comparable to a child being hit by a car travelling 40 mph'.[374] If the Crown experts' views were accepted, Faulder's explanation was inadequate. In the Commission's view, Faulder's explanation was more plausible if Geddes' proposed mechanism of hypoxia and raised intracranial pressure was accepted, as it provided an alternative explanation to inflicted head trauma, such as an accidental injury.

The Court reviewed the medical evidence that N had multiple bruises around the head; subdural haemorrhage; brain swelling and hypoxic-ischaemic injury (HII) in both cerebral hemispheres; and no evidence of retinal haemorrhages. Both the Crown and appellant called several medical experts. Faulder's experts confirmed that the fall described could lead to the injuries observed, especially by affecting the neck and causing interference with the respiratory system and causing HII. The Crown expert, Dr Jaspan, was unable to rule out accidental trauma, as N did not have all the elements necessary to diagnose inflicted injury. However, Crown experts upheld the view that N's injuries were sustained by non-accidental means, most likely blunt force trauma than shaking, while also conceding N could have rolled or arched off Faulder's arm, as he had consistently asserted. At trial, both San Larazo and Alexander had testified that N's

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[373] Ibid n 8, *Harris*, 220.
[374] Ibid n 8, *Harris*, 221.

brain injury was such that severe forces were involved. Consequently, the Crown experts' concession that the injuries might have been accidentally sustained was significant, as it meant Faulder's account might be accurate. The Crown's case at appeal, therefore, had changed from the original prosecution case: Faulder's explanation was seen as plausible; the brain injury was seen as secondary HII, rather than primary intracranial trauma; and the mechanism of injury was revised to blunt force impacts to the head, rather than the severe, violent shaking suggested at trial. The criticism of Dr San Lazaro was overlooked given she was not appearing in the appeal and the Crown's case had changed significantly. In summary, at Faulder's trial and appeal there were five explanations for N's injuries with the prevailing opinion, on appeal, being an impact injury. The Court accepted Geddes' I and II, which found injury severity is correlated with the extent to which the brain is starved of oxygen and/or blood. The Court relied on Faulder's good character and the consistency of his account of the events leading to N's injuries, allowed the appeal and quashed the conviction.

5.6 R v Henderson, Butler & Oyediran [2010][375]

In *Henderson*, the Court of Appeal heard three appeals against conviction. The cases rested primarily on expert medical evidence. Each conviction was based on medical opinion that the deceased infant had been shaken whilst in the care of an adult. The appeals turned on whether medical opinion evidence was of sufficient reliability to meet the criminal standard of proof beyond reasonable doubt.

The first appellant, Henderson, had been convicted of the manslaughter of a child in her care. The question was whether there was evidence independent of and in

[375] Ibid n 8, *Henderson*.

addition to the triad, proving death was non-accidental. The second appellant, Butler, had been convicted of causing grievous bodily harm and cruelty to his daughter. The infant had sustained head injuries and retinal haemorrhages but recovered fully, raising questions about whether there was an alternative cause of injury to shaking. Butler was tried on medical evidence and opinion alone for two counts, firstly, for an incident of falling and sustaining a burn injury and a second incident of apparent shaking. The third appellant, Oyediran, had been convicted of the murder of his son by shaking and throwing him, causing fatal head injuries. There was also a separate fracture of the arm.

5.6.1 Karen Henderson

On 2 March 2005, Maeve Shepherd was in the care of her babysitter, Karen Henderson, when she collapsed suddenly. She was taken to hospital where she died two days later. Henderson was a mother herself and a respected child-minder. Maeve was reported to be well and alert before her collapse, as she was walking around in her walker. The prosecution asserted Maeve had died from shaking or shaking and impact. Eight prosecution expert witnesses testified the triad was a 'strong pointer'[376] to fatal shaking. Henderson denied she had harmed Maeve. The defence case was that Maeve either suffered a seizure or the mechanism of death was unknown. The defence adduced character evidence attesting to Henderson's respected status in the community. Henderson was convicted of manslaughter. Henderson's appeal focussed on ophthalmological and neuropathological evidence that she was unable to explain at the trial.

At trial, there was evidence that Maeve had an upper respiratory tract infection for weeks before her death. However, Henderson described Maeve as healthy on the

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[376] Ibid n 8, *Henderson*, 24.

morning of the day she went to hospital. Then she suffered an apparent seizure and became floppy. After calling emergency services, Henderson attempted to revive Maeve. When the paramedics arrived, Maeve was near-death. She was taken to hospital where she was on life support until her death two days later.

The treating medical specialists agreed Maeve had extensive retinal and subdural haemorrhages and diffuse axonal injury. Inflicted trauma was suspected, as there was no blood clotting disorder. The prosecution argued the triad and the severity of the signs observed provided proof that death occurred from violent shaking. The prosecution relied on two further characteristics of Maeve's injuries consistent only with trauma: traumatic axonal[377] injuries (TAI) in the cortico-spinal tracts and retinal folds. There were eight prosecution experts who testified the triad and the two additional signs were not due to known medical or natural causes.

On appeal, Henderson addressed the evidence of retinal folds. Ophthalmological evidence from examinations conducted while Maeve was still alive indicated that she had retinal haemorrhages in all layers of the retina as well as 360° folds in both eyes. These lesions were considered to be indicative of traumatic, non-accidental injury. After the trial, a new defence pathology expert, Professor Luthert, and a trial prosecution expert, Mr Elston, a practicing ophthalmic surgeon and therefore a clinician, conferred and produced a joint report indicating retinal folds can occur from severe retinal haemorrhaging and are indicative of retinal haemorrhaging, rather than being an independent indicator of trauma, which was the prosecution argument at trial. At the trial, the predominant medical opinion was that the only known cause of retinal folds was trauma. On appeal, the defence proffered a paper describing folds associated

[377] Axons are the part of a neuron that transmits electrical impulses away from the cell body.

with retinal haemorrhaging in a 14 year-old with acute myeloid leukaemia.[378] The defence argued the paper supported the notion that perimacular folds could be caused by events other than inflicted head injury. Further, the defence argued that medical knowledge is fluid and known injury causes change over time. The Court accepted this line of reasoning, while disagreeing that retinal folds are not an additional clinical feature. The Court relied on the clinical experience-based opinion of Elston, who testified that he had only seen retinal folds in cases of shaking or shaking and impact cases in 25 years of clinical practice. Elston did not indicate how he verified his previous cases were actual instances of inflicted trauma. The Court rejected the opinion evidence of Luthert, as he was a pathologist, and took the view that Elston's clinical opinion evidence held greater sway, offering a viable explanation for the retinal folds, while Luthert did not. The Court referred to several other paediatric clinicians who rejected infection as a cause of retinal haemorrhages. The Court found Luthert advocated greater uncertainty and caution, but not to the extent that it rendered the trial verdict unsafe.

The appeal examined the significance of traumatic axonal injury (TAI), the second independent medical feature beyond the triad relied on by the Crown to prove the injuries were inflicted. Prosecution experts in the trial asserted they could distinguish between traumatic axonal and diffuse axonal injury (DAI). The location of the TAI was significant, which was localised to the cortical-spinal tracts. The TAI observed in Maeve's case was different to the type of DAI seen in cases of ischaemia (inadequate supply of blood from obstruction). The prosecution experts relied on Geddes work (I and II) and her reference at the cranio-cervical junction axonal damage as proof that

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[378] Ibid n 8, *Henderson*, 39; see also Bhatnagar, A, Wilkinson, L.B, Tyagi, A.K, and Willshaw, H.E, 'Subinternal limiting membrane hemorrhage with perimacular fold in leukemia' (2009) 127 *Archives of Ophthalmology* 1548 – 1550.

Maeve's injuries were of traumatic origin. Geddes regarded localised axonal damage as a significant factor in considering inflicted head injury, as did Reichard, another researcher, who came to a similar conclusion based on his own review of 73 cases in which the assessor was 'blind' (or unaware) to the clinical history.[379] In the appeal, the defence called on the testimony of Dr Leestma, a retired neuropathologist. His evidence about the pathological characteristics of staining studies examining axonal injury was in conflict with that of the prosecution neuropathology expert, Dr Al-Sarraj. The Court held that Leestma showed limited current knowledge about non-accidental head injuries, the most concerning being that he was unaware of Geddes' research, as a result of which the Court found that his evidence was flawed. The Court held that Leestma did not have sufficient credibility to qualify as a relevant expert. The Court found that the evidence of TAI, in addition to the triad and retinal folds, provided sufficient proof that the verdict was safe.

The issue of the two additional signs was resolved in favour of the prosecution, as the Court accepted the prosecution experts' view that the axonal injury sustained by Maeve was not survivable and she would have been blind from the retinal haemorrhages and folds. This evidence contradicted Henderson's account that Maeve was well and must have had a lucid interval before she collapsed. The Court also found there was no compelling evidence supporting a causal link between hypoxia (loss of oxygen), increased intracranial pressure and subdural haemorrhages – Geddes III, rejected in *Harris & Ors*. The Court referred to the fact that subsequent research failed to

[379] Ibid n 8, *Henderson*, 50.

demonstrate a causal link between hypoxic cardiac arrest and subdural haemorrhages.[380] The appeal was dismissed.

5.6.2 Ben Butler

Ellie Butler's father took her, aged 7 weeks, to hospital on 15 February 2007. She presented with no external head injuries but medical investigations indicated she had suffered a severe head injury, encephalopathy, and multiple subdural and retinal haemorrhages. She was noted to have burn injuries to her forehead and arms. Her father explained she had rolled off a pillow and hurt herself on the radiator when he was caring for her. Immediately after the fall, Butler consulted the family medical practitioner for treatment and no child protection concerns were raised. However, Butler was charged after Ellie's head injuries were confirmed.

Butler was convicted of causing grievous bodily harm and cruelty and sentenced to concurrent terms of 18 months and one month, respectively. The prosecution adduced evidence from 15 medical witnesses and the defence called three medical witnesses. Ellie recovered from her head injury and the case, in the absence of external signs of injury, was primarily tried on the basis of medical opinion evidence. The two charges were tried together, which was a cause of disquiet for the appellate judges, as they considered the burn to indicate carelessness, rather than a prior abusive episode. The prosecution relied on two types of evidence: that of the treating clinicians in emergency, paediatrics and radiology; and those experts asked to express a view about causation. The treating clinicians attributed the injuries to inflicted head injury.

The medical witnesses were drawn from the specialist fields of ophthalmology, paediatric neurology and neuroradiology. The ophthalmic evidence indicated the

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[380] Ibid n 8, *Henderson*, 70.

presence of severe retinal haemorrhages, which the three relevant experts agreed was caused by non-accidental mechanisms. The experts concluded the cause was violent shaking but this was revised when Ellie recovered fully from the haemorrhages – an unexpected outcome. Ellie's recovery raised doubts about medical opinion that Ellie had been severely shaken, especially as one expert was of the view that raised venous pressure, rather than shearing injuries could equally explain the observed triad. The main controversy was disagreement about interpretation of fresh bleeding between two neuroradiologists. One, Dr Stoodley, was a prosecution witness, and the other was Dr Anslow, called for the defence. Stoodley testified the bleeding was fresh blood or blood mixed with cerebro-spinal fluid, there was no evidence of impact trauma and the diffuse subdural haemorrhages were consistent with shaking injury. Anslow observed old blood he attributed to birth-related subdural haemorrhage, a common occurrence. He attributed the observed fresh blood to a re-bleed from birth-related subdural haemorrhage. Stoodley strongly disagreed with this view stating that in the event of a subdural haemorrhage incurred at birth, such injuries resolve in a month and these lesions were unlikely to be due to birth.

The appeal examined the force required to cause a re-bleed and the timing of such force. The experts agreed the causal event would have occurred immediately before the baby became floppy, which was the only evidence that established Ellie was injured in her father's care. However, Ellie's recovery was inconsistent with the notion of severe shaking leading to retinal haemorrhages, as recovery was unlikely with such severe injuries. The judges concurred with this view and attributed the mechanism of injury to unknown causes. The Court was critical of the trial judge's management of the trial, particularly regarding the weight to be assigned to the unchallenged ophthalmic evidence (that is, the recovery from retinal haemorrhages) and how to deal with unknown causes

of injury in their deliberations. Rather than evaluating whether the presence of the triad supported a shaking causal mechanism, as in the other appeals, the judges were concerned with whether there was other evidence that was so compelling that unknown causes could have properly been excluded by the jury. They concluded that there was no basis on which the jury could reject an unknown cause in the context of the resolved ophthalmological signs. The Court reasoned that once this proposition was accepted, Stoodley's evidence was diminished. The trial judge was criticised for failing to properly direct the jury, as he had only chronologically read out the experts' evidence. The Court quashed both convictions.

5.6.3 Oladapo Oyediran

Oyediran was convicted on 16 March 2007 for the murder of his 10 week old son, Oluwafemi ('Femi'). Oyediran was tried for murder, as well as causing or allowing the death of a child. Femi's mother, Sophia Rudder, was originally charged with murder also, but she suffered from multiple sclerosis (MS), and the Crown decided not to proceed against her on that charge. She subsequently died. Oyediran was sentenced to life imprisonment with a minimum of 13 years.

The prosecution case was that Oyediran murdered Femi on 18 October 2005 by inflicting head injuries that led to his death. The cause of the injuries was attributed to shaking, throwing or a combination of both. The proximal mechanical cause of death was inhalation of gastric content from the stomach, as brain damage had affected the infant's gag reflex resulting in inhalation of the stomach contents. Oyediran and Rudder were arrested after a post-mortem conducted by Professor Risdon. Oyediran denied he had harmed Femi, refuted the injuries identified in the autopsy and asked for an independent autopsy.

The prosecution called five medical witnesses, while the defence called one. The experts primarily agreed about the injuries found and the mechanism of death. The issues in dispute were whether: the injuries were due to an accidental short fall, especially if, as claimed by Oyediran, Ms Rudder had nearly dropped Femi and he was pulled back violently by her; the second brain injury was a re-bleed of an earlier brain injury, rather than being a separate injury; and the arm fracture was due to being grasped in an attempt to stop a fall by Rudder. Risdon found subdural haemorrhages, brain swelling and haemorrhaging around (not within) the optic nerves. He concluded that the clinical history did not explain the injuries, leaving inflicted head injury as the likely cause. Although there was no retinal haemorrhage, Risdon testified in cross-examination that the pattern of injuries is 'almost always non-accidental'.[381] He did not believe the injuries were re-bleeds or birth-related subdural haematomas as they are not the 'type' he would associate with 'one caused at birth'[382] or that a short fall was the cause, as injuries from short falls are different. In re-examination, Risdon reiterated that short-distance falls were common in ambulant children, and he rejected Plunkett's study,[383] which found injuries could be incurred from short-distance falls, on the basis that the children in the study were not individually examined. Risdon substantiated his opinion with reference to his clinical experience in which he had seen three children who had died from short-distance falls who were older and their injuries were different to those found in Femi's case.

The defence expert, Dr Rouse, concurred with Risdon's post-mortem conclusions that the head injury occurred on two separate occasions and the fracture was

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[381] Ibid n 8, *Henderson*, 150.
[382] Ibid n 8, *Henderson*, 150.
[383] Ibid n 302, Plunkett study.

two weeks old. He did not agree that it was possible to attribute the fracture to accidental or non-accidental causes. Rouse stated that the absence of retinal haemorrhages suggested the force used was 'less than that found in traditional shaken baby'[384] cases. Rouse's opinion was that a fall from shoulder height might have caused the injuries, especially if Femi had a previous head injury, and another impact to the head might have increased the chances of a re-bleed. However, he stated the evidence overall indicated the head injury was non-accidental.

Dr Harding, a neuropathologist, concurred with the other experts and he emphasised the severity of the lesions. He attributed the brain haemorrhages to torsional twisting leading to damage to cortical bridging veins. Harding also found axonal damage, which he dated as occurring around the time of the second brain injury. In cross-examination, Harding dismissed the notion of a re-bleed and shortfall as a potential cause. Similarly, Professor Luther, an ophthalmologist, confirmed the absence of retinal haemorrhages and attributed haemorrhages on the optic nerves to inflicted trauma. Professor Hall, paediatric radiologist, testified that the fracture was two – four weeks old, caused by a direct blow to the elbow or hyperextension of the arm, and was unlike shaking or child abuse injuries. She asserted that the fracture would have been painful and caused by 'excessive and unusual force".[385]

Oyediran gave evidence in his own defence and testified that he had not harmed Femi or observed any of the fracture signs. He referred to an incident in which Femi fell off the bed but was fine and conscious (he had not told the police of this fall). There were questions about Oyediran's character based on evidence adduced by the

[384] Ibid n 8, *Henderson*, 152.
[385] Ibid n 8, *Henderson*, 159.

prosecution that Oyediran pretended to others that he was a doctor. He denied these allegations.

The basis of the appeal was new evidence from two specialists, Drs Squier and Jones. Oyediran's case was that Femi suffered brain damage two weeks before he died after falling from his mother's arms. Dr Jones testified that there was 'general acceptance'[386] about the gravitational force required to cause fatal injuries, 100-150 G being the maximum limit. He stated there would have been serious head injury if the baby had fallen from the mother's shoulder height. The prosecution called Dr Al-Sarraj in rebuttal to emphasise that biomechanical studies are difficult to apply to humans and he stressed that such serious injuries would not occur from a low level fall two weeks before the baby died. The Court referred to the Cherry judgment in *Harris & Ors* that also addressed biomechanical issues and the fledgling state of the discipline.[387]

The Court agreed with the jury that Sophia Rudder would have been incapable of handling Femi and therefore Oyediran's assertion that she dropped or tried to catch the baby was incorrect. The Court accepted medical evidence that Femi would have been in considerable pain after sustaining the injuries and, if Oyediran had ignored his distress, he must have been responsible for the death, as well as having an intention to harm Femi.

The Court agreed with evidence from Dr Squier that the fact of an unusual fracture supported the theory that Femi died from inflicted trauma. Dr Squier did hypothesise, however, that HIV encephalitis was the cause of the mother's apparent MS signs. She referred the case to Professor Bell, an expert in paediatric HIV. Bell found no

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[386] Ibid n 8, *Henderson*, 180.
[387] Ibid n 8, *Henderson*, 182.

evidence of HIV or AIDS illnesses. Al-Sarraj also testified about the difference between the brain characteristics of HIV and inflicted head injury children. The Court expressed disappointment that Squier did not retract her opinion based on Bells' evidence, despite referring to Bell as an expert in paediatric HIV. The judges noted that Squier's manner 'casts doubt about the reliability of the rest of her evidence and her approach to this case…demonstrates that she was prepared to maintain an unsubstantiated and unsupportable theory in an attempt to bolster the appeal'.[388] The Court also criticised Squier for suggesting Rudder was suffering from HIV, not MS, despite Rudder's own eminent neurologist Dr Foster's confirmation that she had MS. The judges concluded that Squier's evidence in this aspect was unreliable, as she should have credited Foster with having an accurate view because she was the treating clinician for Rudder and her reputation and qualifications were exemplary. The judges rejected Squier's evidence due to its poor quality and decided that it provided an insufficient basis for undermining the safety of the verdict.

A central inculpatory issue with Oyediran was his lack of attention or care about the catastrophic injuries Femi sustained in the weeks before his death. Prosecution experts had testified that Femi would have been in extreme pain and sustained damage to his brain after the injury, some two weeks before his death. The Court dismissed the notion that Ms Rudder had in any way accidentally harmed Femi. The judgment emphasised medical evidence that Femi would have been in a compromised state, which Oyediran did not respond to in any meaningful way. The appeal was dismissed.

The Court read down several points about jury directions, including the notion that medical knowledge evolves and changes and juries need to be cautious when expert

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[388] Ibid n 8, *Henderson*, 188.

opinion evidence is fundamental to the prosecution of a case and juries require assistance in dealing with conflicting expert evidence:

> *...a jury needs to be directed as to the pointers to reliable evidence and the basis for distinguishing that which may be relied upon and that which should be rejected.*[389]

The Court held that a joint statement by experts of areas in which they agree and disagree and limitations of medical evidence is a necessary precursor to a trial conducted on a rational basis so that the jury is directed appropriately and is able to logically reason through conflicting expert opinion. The Court noted, in child death cases, the prosecution would not necessarily have proved its case where 'an array of experts' has been used to identify a non-accidental injury and the defence is unable to identify an alternative cause. The Court acknowledged that:

> *The strength of a proposition in medicine depends upon the strength of the medical evidence on which it is based.*[390]

The court emphasised the need to alert juries to the real possibility that an unknown cause should be considered: that is, unless the evidence prevents the exclusion of 'any real possibility of an unknown cause, they cannot convict'.[391]

5.7 Conclusions

The appellate cases described in this chapter primarily dealt with the reliability of medical opinion evidence and resolution of conflicting expert testimony in triad death cases. Typically, at the pre-trial stage, judges in common law countries such as England,

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[389] Ibid n 8, *Henderson*, 218.
[390] Ibid n 8, *Henderson*, 6.
[391] Ibid n 8, *Henderson*, 217.

Wales and Canada, are not required to assess the reliability of expert evidence; rather, the threshold question is whether the evidence is probative and not unfairly prejudicial. This means the comparative reliability of conflicting medical opinion evidence became questions for appellate courts to resolve.

The reliability of medical opinion about causes of the triad is itself unresolved in the medical community.[392] The fundamental problem is discerning the aetiology of the triad, as there is no independent corroboration that assumed shaking deaths are actually instances of death from shaking. Research demonstrating *causal* links between shaking and the triad is non-existent. Nonetheless, medical experts have made causal inferences about the cause of the triad, based on the *correlation* of the triad with putative shaking mechanisms. Medical experts in these appeals failed to advise courts of the limits of their ability to identify the causal mechanism preceding the triad and that their opinion is frequently based on clinical experience of unknown reliability. Experience is forwarded as proof the triad results from shaking, despite failing to provide evidence of independent corroboration of their hypothesis. Presumably, if such evidence existed, medical experts would testify about it, as it is powerful confirmation of their opinion. Even when several physicians agree about their particular clinical opinion, as occurred in the appeals, there is still a need to demonstrate that the methods and derivative opinions proffered by each expert is reliable, as agreement or consensus is not a substitute for opinions that are demonstrably reliable and accurate.

In these appeals, there was extensive conflicting expert evidence. Judicial evaluation of the merits of medical opinion seemed to be based on criteria upon which the evidence was initially admitted to trial: that is, the expert's credentials, general

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[392] See discussion on medical knowledge on SBS in Chapter 4.

acceptance within the medical community, and current clinical experience. None of which provides insights about the accuracy of medical inferences about the mechanism of death. The judges seemed to value expertise and knowledge gained from clinical over research experience. Ongoing clinical experience was depicted as a necessary foundation for developing expert knowledge. This reasoning assumes experience and accurate and reliable knowledge development are interchangeable constructs. Possible explanations for the apparent judicial preference for clinical over other types of medical evidence may be due to relevance (the opinion of a clinician being more applicable to the specific case being decided) and assigning relatively greater weight to proof from authority, based on the expert's credentials, rather than science or scientific methodology.

SBS research and clinical knowledge relies on *suspected* or *assumed,* not proven, shaking cases. Medical experts' testimony that the triad, in their experience, is due to shaking is vulnerable to the same corroboration problem faced by researchers. Empirical research suggests the triad is not specific to putative shaking cases and a causal relationship between shaking and the triad has not been confirmed. Despite this, experts have endorsed the accepted/shaking hypothesis. The development of expertise depends on feedback on diagnostic accuracy,[393] which clinicians and researchers in SUDI rarely have. This means there is significant uncertainty about the reliability of derivative clinical opinion evidence and whether it can support the criminal standard of proof, which also depends on its admissibility and other incriminating evidence.

The appeals focussed extensively on findings and hypothesis published by Geddes and her team, Geddes I, II and III, respectively. Geddes I and II described

[393] See discussion of expertise in Chapter 7.

autopsy findings, while Geddes III proposed an alternative hypothesis to shaking to account for the triad. As there was an absence of legal or medical criteria for assessing the reliability of Geddes' work, the Court relied on general agreement/acceptance to evaluate her findings. For example, in *Harris*, Geddes I and II were accepted because they had 'been largely accepted by the scientific community'.[394] The fact that 'the results of this research… are not challenged by those who criticise the unified hypothesis'[395] was also relied on to support the Court's acceptance of Geddes II. However, the basis of the medical experts' acceptance and rejection of Geddes' publications seems to be the assertion that shaking trauma causes the triad, with little to support this view, other than their own clinical experience or belief – both of unknown reliability and accuracy.

The Court held that the triad and its cause was 'itself a hypothesis'[396] rather than an established doctrine. Despite this insight, the court rejected Geddes III on the basis of Geddes' concession in her testimony that it was a hypothesis, and the lack of general acceptance of this hypothesis. The Court seemed to require medical evidence to be more than a hypothesis for legal purposes, a view it applied to Geddes' evidence, but not to other medical evidence also relying on the *hypothesis* that shaking causes the triad. General acceptance by clinicians seemed to be favoured over systematic exploration of the reason some infants present with a triad of injuries. Geddes has methodically documented her observations from autopsies of abused infants and how it applies to her hypothesis and theory, a routine practice in research, whereas many of the clinical experts who testified referred to their clinical experience in general terms without clarifying the foundation and proof for their opinion. Consequently, it is difficult to

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[394] Ibid n 8, *Harris*, 256.
[395] Ibid n 8, *Harris*, 75.
[396] Ibid n 8, *Harris*, 69.

assess the reliability and accuracy of opinion testimony examined in the appeals. It is noteworthy that Geddes never set out to prove trauma was *not* the cause but that there may be *other* explanations of non-abusive origin – a theory that needed to be tested for accuracy. The concession Geddes made in testimony that she was not presenting her findings and hypothesis as fact was accorded considerable weight by the Court, in an apparent misunderstanding of scientific method. Although Geddes had unsuccessfully requested that the publishers describe her paper a 'Hypothesis' paper, she nonetheless referred to her argument as a hypothesis in her paper (Geddes III).[397] The seemingly limited judicial understanding of scientific method is illustrated in the judges' response to medical opinion evidence that disagreed with Geddes III. The judges cited the opinion of Dr Jaspan[398] in *Rock* that there was no swelling in Heidi's brain as proof that Geddes' hypoxia/brain swelling hypothesis is wrong. There are problems in the Court's approach in this instance. Firstly, logical reasoning is the basis of judicial appraisal of expert evidence and, if a finding is inconsistent with the hypothesis, the hypothesis seems to be rejected. Secondly, a negative finding in a specific case is not a sufficient reason to abandon a theory or hypothesis. Thirdly, Geddes' acknowledgement that her theory is not fact stands in stark contrast to Crown and defence experts' opinion evidence that does not clarify that shaking is *also* a hypothesis, not fact – a hypothesis, moreover, confirmed by anecdotal or subjective impressions, instead of systematically documented evidence. This approach contradicts the Court's own observation that shaking is still a hypothesis and it is not for courts to resolve disagreements in medical opinion; rather the purpose of the Court is to decide on the safety of the verdict based on the evidence

[397] Ibid n 8, *Harris*, 58.
[398] Ibid n 8, *Harris*, 68.

presented to it. The Court has effectively applied the same flawed logic to the shaking hypothesis, as the proponents of shaking or SBS.

The distinction drawn by the Court between a hypothesis and the knowledge or evidence needed to act upon in Court is troubling. Scientists would argue that *any* proposition or explanation is a hypothesis that has not been disproven. In this sense, all propositions are only as reliable and accurate as the present state of knowledge suggests. The court itself held that the 'accepted' view of shaking as the cause of the triad was a hypothesis, yet went on to accept general expert agreement – as opposed to independent corroboration – as confirmation that shaking was thereby proven. It is possible that the judges' comments reveal a basic misunderstanding of scientific terminology and the manner in which scientific knowledge develops.

Despite over 700 articles on SBS,[399] shaking aetiology has not been confirmed in the triad literature, yet experts failed to disclose this to the Court. The assumed proof for shaking derives from *suspected*, not independently *proven*, triad cases. Given that trauma/shaking is as much a hypothesis as Geddes III, it is not clear why the Court attributed greater weight or authority to agreement based on clinical experience – and beliefs – of testifying experts. As the Court is dependent on medical experts to accurately convey limitations and uncertainties in their knowledge, it is difficult to see how it could independently discern methodological problems that raise doubts about the accuracy of shaking as a causal explanation for the triad.

Another issue raised by Geddes' work is related to publications and their role in establishing peer-reviewed opinion. There has been a longstanding tendency to publish research with positive or hypothesis confirming findings, rather than publishing

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[399] See Ibid n 274, Narang.

all research undertaken. Notable exceptions are PLosS and the Library of Science, which endorse the latter approach within the scientific community. This approach would present a more comprehensive perspective on the findings of research, including results that confirm and disconfirm hypotheses. This method also aligns with the scientific practice of testing hypotheses and refining knowledge over time. In this context, the editor's refusal to allow Geddes to publish her studies as hypotheses supports the notion that peer-reviewed publications are, in effect, only examples of research that confirms a hypothesis and, therefore, provides a skewed perspective on medical knowledge on the triad.

The appellate Courts' responses to Geddes' work was followed by medical commentary and case reports in medical journals[400] that relied on the (faulty) reasoning of the judiciary with regard to Geddes' work to dismiss her research. These events reveal a troubling dimension in the interface between medical and legal communities in SUDI cases. The medical community substantiates its stance that shaking causes the triad by reference to convictions or appellate court rulings. Similarly, appellate courts have relied on the published or testified views of the experts who cite the court's judgments as proof of shaking causing the triad. Apart from being an example of circular reasoning, this type of reasoning in law and medicine does not constitute independent proof about the accuracy of a hypothesis. In the absence of independent verification of the cause of the triad, this type of medico-legal reasoning is unreliable.

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[400] See for example, Richards, P.G., Bertocci, G.E., Bonshek, R.E., Giangrande, R.M., Gregson, R.M., Jaspan, J.T., Jenny, C., Klein, N., Lawler, W.,Peters, M. Rorke-Adams, L.B., Vyas, H., and Wade, A, 'Shaken Baby Syndrome' (2006) 91 *Archives of Disease in Childhood*, 205-206.; Punt, J, 'Inflicted head injury in infants: issues arising from the Geddes hypothesis' 91 (2006) *Archives of Disease in Childhood*, 714-715; Dyer, C, 'Diagnosis of "shaken baby syndrome" still valid, appeals court rules' (2005) 331 *BMJ* 253; Dyer, C, 'Court of Appeals issues guidance on shaken baby syndrome' (2010) 340 *BMJ* 3318.

Henderson clarified the circumstances in which new evidence can be adduced in a field of evolving knowledge and 'how' to resolve conflicting expert opinion. The Court noted that, in child death cases, the prosecution would not necessarily have proved its case where 'an array of experts' has identified a non-accidental injury and the defence is unable to identify an alternative cause. This is important, as the accused's inability to explain how the triad occurred has been taken as evidence of guilt. Such a line of reasoning is unjust to the accused as, if the accused is innocent of wrongdoing, they do not know how the infant died and, as is often the case, neither do medical experts. This reasoning shifts the burden of proof to the accused. The prosecution may have been able to exclude every possible known cause but the evidence may still be insufficient to exclude, beyond reasonable doubt, an unknown cause.

The judges in *Harris* and *Henderson* provided guidance on admissibility of medical opinion evidence and jury directions in triad cases. Firstly, the judges recommended that, in cases that depend on expert evidence, the judge who will hear the case should conduct the pre-trial hearing and have experience with complex medical evidence, and the critical medical issues should be made evident in advance of the trial. The Court stressed the role of the trial judge was to assess the admissibility of expert evidence based on current admissibility criteria: permissible expert testimony and sufficient knowledge based on study or experience to be able to provide an opinion that helps to resolve issues before the Court.[401] Given that medical experts have not disclosed gaps in their knowledge, and indeed may be unaware that their understanding of the triad is incomplete, it is not clear how a judge, no matter how astute, will assess the 'sufficient knowledge' criterion. More importantly, the fact that unreliable medical opinion

[401] Ibid n 8, *Henderson*, 219.

evidence has been presented in cases that were later found to be wrongful convictions supports the need to develop reliability standards that can be applied to the content of the opinion evidence in advance of trial.

Secondly, *Henderson* held that a joint statement by experts of areas about which they agree and disagree and limitations of medical evidence is a necessary precursor to a trial conducted on a rational basis so that the jury is directed appropriately and is able to logically reason through conflicting expert opinion. The importance of this approach cannot be overstated, if the jury is to render a correct verdict. The Court made recommendations for judicial directions and summing up, emphasising the need to alert juries to the real possibility that an unknown cause should be considered: that is, unless the evidence prevents the exclusion of 'any real possibility of an unknown cause, they cannot convict'.[402]

The appeals highlight the problems inherent in a legal system that does not impose reliability standards before admitting medical opinion evidence. In the real world, future cases will be tried with ongoing uncertainty about the reliability of medical opinion evidence. Lower courts do not always have the benefit of the extensive guidance provided to appellate courts by experts and judicial inquiries, as was the case in both the English and Canadian appeals. This means that there are likely to be continuing problems as courts try to resolve conflicting testimony between apparently reputable experts. Even at appellate level, the triad appeals suggest that judicial assessment of evidentiary reliability rests more on factors such as expert credentials and general acceptance – the basis for admitting expert evidence – rather than analysis of testimony content. General acceptance itself can be misleading, as a group of like-minded experts

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[402] Ibid n 8, *Henderson*, 217.

is likely to support the views of similarly aligned individuals, even if their collective opinion is wrong.[403] To date, determination of the reliability and accuracy of medical opinion evidence has been left to legal trial management mechanisms, such as cross-examination, judicial instructions and jury deliberations. Seen in the context of the examined appellate judgments, there is no reason to trust that, once admitted, legal processes are effective in clarifying to the jury the limitations of medical – especially clinical opinion – evidence in controversial areas such as SUDI. These concerns are not limited to medical opinion evidence in SUDI cases as, in common law countries, trial judges dealing with other types of forensic science and expert evidence also do not assess for evidentiary reliability.[404] Consequently, expert evidence of uncertain value has been allowed into criminal trials for other crimes, with resultant concerns about the safety of verdicts based on such evidence.

SUDI trials consist of a variety of evidence, including medical and psychosocial. The influence of psychosocial evidence is particularly evident in *Oyediran*. This case is atypical as there are many apparent psychosocial concerns. Oyediran had been aggressive and verbally and physically abusive to his partner, and outsiders, such as staff at their medical practitioner's office and the housing representative. The Court accepted the medical evidence that Femi would have been in considerable pain and if Oyediran had ignored his distress, he must have been responsible for his death, as well as intending to harm Femi. This reasoning is an inference of intent based on equivocal physical 'facts'. The correlation assumed between psychosocial factors and medical opinion evidence is not necessarily justified.

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[403] See discussion of 'illusions of validity' (accuracy) experienced by like-minded experts in Chapter 7.
[404] Ibid n 24.

Psychosocial evidence is problematic, as its reliability is unknown and personality patterns of carers who murder infants are also largely unknown, meaning this type of evidence can be unfairly prejudicial. The critical point is that all evidence, both medical and non-medical, should be tested for reliability and accuracy, if wrongful convictions are to be avoided in the future. Whether psychosocial evidence is actually cogent cannot be determined without a measure of its reliability.

In *Oyediran* there is also misleading medical testimony, given the current empirical research on triad deaths. For example, Dr Rouse stated that the absence of retinal haemorrhages suggests the force used was 'less than that found in traditional shaken baby'[405] cases. This type of testimony implies there is a *known* causal mechanism and degree of force preceding the triad. Rouse also attributed subdural haemorrhages to torsional twisting leading to damage in veins, although it is not clear whether haemorrhages are incurred by this mechanism, as the bleeds observed by Geddes were thin film rather than the deep bleeds expected in cortical venous shearing. Another expert, Dr Hall, a paediatric radiologist, asserted that the fracture would have been painful and caused by 'excessive and unusual force'.[406] Yet the necessary force to produce injuries is unknown and this type of evidence is clinical opinion of unknown reliability, and is likely misleading.

The appeals raise the questions of what constitutes a reliable way of approaching conflicting medical opinion and assessing the worth of medical opinion? The appellate judgments in the triad cases do not adequately address this issue. Ultimately courts need guidance on how to assess the reliability of medical opinion

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[405] Ibid n 8, *Henderson*, 152.
[406] Ibid n 8, *Henderson*, 159.

evidence in triad deaths. This could be achieved via an advisory panel that informs the court about current research and understanding of triad deaths and applies this knowledge to the facts of the specific case.

Chapter 6: Psychosocial correlates of filicide

The decision or opinion as to whether an infant death constitutes filicide rests not only on medical evidence on the mechanism of death but also considers psychosocial factors. Although in a criminal trial a medical expert is required to limit his or her opinion to findings of the autopsy, both paediatricians and pathologists routinely consider psychosocial factors in their determination of the mechanism of death, either overtly or covertly. Some child protection paediatricians believe that it is part of their expertise to consider psychosocial factors, which are informed by the opinion of other staff in these teams, such as social workers.[407] Psychological research has demonstrated that context, such as psychosocial factors, can bias expert decision-making.[408] Decision-making that includes contextual factors that may be unrelated to determining the mechanism of death is vulnerable to bias when the decision task requires a reliable and accurate opinion based primarily on medical evidence. This is especially so when the context does not provide discernible cues to distinguish between deaths that constitute filicide and those that do not. The reason it is argued that contextual factors of a given case might be unrelated is that many individuals with similar psychosocial factors to the accused parents do not harm or kill their infants.

Psychosocial and psychiatric factors related to SUDI can be distinguished. Psychosocial factors typically refer to the accused's family, income, level of stress, and relationship quality.[409] Psychiatric characteristics refer to mental illness that fulfils

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[407] See Ibid n 23; Ibid n 98.
[408] See Chapter 7, sub-section 7.6.
[409] The psychosocial and psychiatric aspects of maternal filicide and the reliability of these factors as indicators of filicide is an important area of SUDI investigation. There is an extensive literature in the disciplines of social work, psychology and welfare attempting to clarify the role of these factors. This discussion briefly examines this issue but it is an important future area of research, as these factors represent a considerable body of evidence in SUDI trials.

criteria for a particular diagnostic classification system and constitute intra-psychic aspects of the accused. The discussion focuses primarily on psychosocial factors, as none of the accused had a mental illness, apart from Anthony who was diagnosed with Histrionic Personality Disorder.[410] Although the cases to be examined involve fathers or stepfathers in cases of triad deaths, research on psychosocial factors primarily focuses on mothers, which necessarily limits the scope of the following discussion.

As with research on medical aspects of filicide, the classification of a case as filicide depends on convictions,[411] without independent corroboration that the cases are actually filicides. The literature on filicide is further complicated by the varying circumstances in which death occurs, including the perpetrator's intention. Bourget and Bradford[412] proposed a taxonomy consisting of five categories of filicide taking into account clinical situation and motive: maternal pathological, accidental, and retaliating filicide, neonaticide and paternal filicide. Pathological filicide applies when the perpetrator has a major psychiatric illness. Psychotic or altruistic motives may underpin this type of filicide and includes filicide-suicide. Accidental filicide refers to death due to child abuse, including battered-child syndrome and Munchausen Syndrome by Proxy.[413] Retaliating filicide refers to filicide committed to punish a partner and neonaticide refers to the filicide of an infant within the first 24 hours of life. Neonaticide is associated with young maternal age and unwanted pregnancy. Accidental or fatal

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[410] Ibid n 8, *Anthony*.
[411] Stroud, J, and Pritchard, C, 'Child homicide, psychiatric disorder and dangerousness: A review and an empirical approach' (2001) 31 *British Journal of Social Work* 249-269.
[412] Bourget, D, and Bradford, J.M.W, 'Homicidal parents'(1990) 35 *Canadian Journal of Psychiatry* 233–8; 'The place to find sufficient material to independently corroborate pathological findings with filicide is the cases of homicide/suicide', Cordner, S Personal communication, 2013.
[413] Meadow, R, 'Munchausen syndrome by proxy' (1980) 55 *Archives of Diseases of Childhood* 731–2; Schreier, H.A, and Libow, J.A, *Hurting for Love: Munchausen Syndrome by Proxy* (New York, Guilford Press, 1993).

abuse filicide seems to apply to the cases of SUDI discussed in the thesis. This type of filicide is not premeditated because the motive is to discipline or control the infant.[414] Consequently, research has examined psychosocial and psychiatric factors that might explain the perpetrator's alleged actions. In the appellate cases examined, the prosecution adduces psychosocial evidence as proof of a sequence of events leading to the mother losing control and fatally abusing her infant. Medical opinion evidence tends to be used to corroborate these accounts and is often presented as independent corroboration even when the expert drew upon psychosocial factors.

A variety of psychosocial factors have been studied that suggest there is a correlation between filicide and a mother experiencing a multitude of stressful events preceding the offence: being primary caregiver of at least one child; financial and housing problems; social isolation; single motherhood; work-related stress; mother's own upbringing, including experiencing childhood abuse; traumatisation; ongoing relationship problems and domestic violence; conflict with family members; jealousy; alcohol and substance abuse; and physical illness.[415] Compared to mothers who kill their newborns, mothers who commit filicide are usually married, report elevated stress and lack of social support and resources at the time they committed the offence.[416] Women

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[414] Bourget, D, and Gagne, P, 'Maternal filicide in Que´bec' (2002) 30 *The Journal of the American Academy of Psychiatry and the Law* 345–51.
[415] Ibid; Haapasalo, J, and Petaja, S, 'Mothers who killed or attempted to kill their child: life circumstances, childhood abuse, and types of killing' (1999) 14 *Violence Victims* 219 –39; McKee, G.R, and Shea, S.J, 'Maternal filicide: a cross-national comparison' (1998) 54 *Journal of Clinical Psychology* 679-87; Saisto, T, Salmela-Aro, K, Nurmi, J. E, & Halmesmaki, E, 'Psychosocial predictors of disappointment with delivery and puerperal depression: A longitudinal study' (2001) 80 *Acta Obstetricia et Gynecologica Scandinavica* 39-45.
[416] Resnick, P.J, 'Child murder by parents: a psychiatric review of filicide' (1969) 126 *American Journal of Psychiatry* 325–34; d'Orban, P.T, 'Women who kill their children' (1979) 134 *British Journal of Psychiatry* 560 –71; Ibid n 414; Ibid n 415, McKee.

who killed their children were socially isolated,[417] and had a history of childhood abuse.[418]

Although psychosis and suicide attempts are common in psychiatric filicide populations, these factors are not characteristic of women who fatally abuse their children,[419] while personality disorders and intense psychosocial stress at the time of the fatal abuse are common.[420] Parental separation in childhood and marital violence have been identified as co-existing factors in fatal child abuse by mothers, and many perpetrators of fatal abuse have a history of abuse in their own childhood.[421] However, it is not the case that *all* mothers who were abused as children go on to fatally abuse their own children. It is likely the population of women who kill their infants have a higher preponderance of a history of childhood abuse but the wider population of abused children who become mothers do not fatally abuse their infants.

There is considerable evidence that a substantial portion of maternal filicides do not involve a severe mental illness that precluded the perpetrator's awareness of the wrongful nature of their actions.[422] Reasons such as wanting to punish the father or

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[417] Simpson, A, and Stanton, J, 'Maternal filicide: a reformulation of factors relevant to risk' (2000) 10 *Criminal Behaviour & Mental Health* 136-47.
[418] Ibid n 415, Haapasalo.
[419] Ibid n 414; Lewis, C.F, and Bunce, S.C, 'Filicidal mothers and the impact of psychosis on maternal filicide' (2003) 31 *The Journal of the American Academy of Psychiatry and the Law* 459-70; Husain, A, and Daniel, A, 'A comparative study of filicidal and abusive mothers' (1984) 29 *Canadian Journal of Psychiatry* 596-8.
[420] Scott, P.D, 'Parents who kill their children' (1973) 13 *Medicine, Science & The Law* 120-6; Ibid n 402, d'Orban; Cheung, P.T.K, 'Maternal filicide in Hong Kong' (1986) 26 *Medicine, Science & Law* 185–92; Ibid n 415, Haapasalo; Marks, M.N, 'Characteristics and causes of infanticide in Britain' (1996) 8 *International Review of Psychiatry* 99-106.
[421] Brewster, A.L, Nelson, J.P, and Hymel, K.P, 'Victim, perpetrator, family, and incident characteristics of 32 infant maltreatment deaths in the United States Air Force' (1998) 22 *Child Abuse & Neglect* 91–101.
[422] Hatters-Friedman, S, and Resnick, P, 'Neonaticide: Phenomenology and considerations for prevention' (2009) 32 *International Journal of Law and Psychiatry* 43-47; Meyer, C, and Oberman, M, *Mothers who kill their children: understanding the acts of moms from Susan Smith to the "prom mom."* (New York, NYU press, 2001); Ibid n 415, Haapasalo.

remove an unwanted infant were more common than mental illness.[423] Similarly, in a Finnish study [424] of 15 filicides, less than 30% of the women reported any psychological issues.

Research on the relationship of child abuse, the influence of psychosocial factors and filicide is limited. Filicide in the context of child abuse appears to be primarily accidental, with no specific intention to kill.[425] Although fatal abuse filicide can be the result of an isolated event, it often occurs following recurrent abuse.[426] Population studies have found that one in two fatally abused children have been victims of prior abuse.[427] A prior history of abusive behaviour towards the deceased infant ought to be considered when evaluating whether an infant death constitutes homicide.

Some researchers have suggested that murder of infants less than 12 months of age is associated with anger. An analysis comparing neonaticide and filicide found filicide was associated with anger.[428] The difficulty with identifying characteristics of women who are likely to murder or who have murdered is exacerbated by findings that personality test results for women who murder children are not significantly different from those who murder adults.[429] Emotional states, such as anger, and personality problems are not sufficiently specific to be reliable indicators that distinguish between different types of homicide and filicide.

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[423] Ibid n 416, d'Orban.
[424] Ibid n 415, Haapasalo.
[425] Ibid n 415, Haapasalo.
[426] Fornes, P, Druilhe, L, and Lecomte, D, 'Childhood homicide in Paris, 1990 –1993: a case report of 81 cases' (1995) 40 *Journal of Forensic Science* 201– 4; Ibid n 419; Korbin, J.E, 'Fatal maltreatment by mothers: a proposed framework' (1989) 13 *Child Abuse & Neglect* 481–9; Browne, K, and Lynch, M, 'The nature and extent of child homicide and fatal abuse' (1995) 4 *Child Abuse Review* 309-16.
[427] Ibid n 421, Brewster et al; Ibid n 426, Browne & Lynch.
[428] Krischer, M, Stone, M, Sevecke, K, and Steinmeyer, E, 'Motives for maternal filicide: results from a study with female forensic patients' (2007) 30 *International Journal of Law and Psychiatry* 191-200.
[429] McKee, G, Shea, S, Mogy, R, and Holden, C, 'MMPI 2 profiles of filicide, mariticidal and homicidal women' (2001) 57 *Journal of Clinical Psychology* 367-374.

Smithey[430] puts forward a sociological perspective on maternal filicide and challenges the broad notion that women who kill have mental illness. She applied three theoretical categories in examining her sample of women who had fatally injured their children: social learning, economic deprivation, and self-attitude. The social learning predisposing factors from childhood included: experiencing childhood family violence; abusive parent-child interactions; paternal substance abuse; poor attachments with parents; and an abusive or unsupportive partner in adulthood who replicated the mother's main socialisation agents from childhood. Economic deprivation and adverse living conditions were also part of the social vulnerabilities that influenced mothers who killed their children. Smithey's sample was different to other studies of maternal filicide, in that none of these women had a formal history of past and current psychiatric diagnosis, and all of the infant deaths were unintentional – the infants died from 'accidental' fatal abuse. Smithey argued that the deaths were due to a culmination of distal (predisposing factors from childhood) and proximal (precipitating factors of economic deprivation, poor social and emotional support – notably the absence of the biological father – and substance misuse) factors. Other studies have supported this view that it is a confluence of factors that are associated with fatal abuse.[431]

The psychosocial correlates of maternal filicide are factors that may indicate risk and should form the basis of assessment to prevent filicide and ongoing maternal and family dysfunction. However, it has not been demonstrated that relying on such factors is a reliable way of deciding whether an infant was murdered. All studies examined rely on correlational statistics, which demonstrate that certain factors may co-

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[430] Smithey, M, 'Infant homicide at the hands of mothers: Toward a sociological perspective' (1997) 18 *Deviant Behavior* 255-272.
[431] Ibid n 420, Cheung; Ibid n 416, d'Orban.

exist with filicide, but do not establish a causal link between psychosocial variables and filicide. There is also a concern that child death investigation based on equivocal medical evidence and, arguably, similarly uncertain correlational information on psychosocial factors is inherently unreliable and vulnerable to errors.

It is important to note that the mothers in the appellate cases discussed in the thesis all denied harming their infants and were not diagnosed with mental illness except in the case of Anthony, in which she was diagnosed with a personality disorder.[432] Therefore, research relating to convicted mothers may not be relevant to this population. It may be that medical and psychiatric experts are generalising from findings about other mothers who were convicted to the specific cases before the court. However, neither psychiatric nor psychosocial research makes clear whether it draws its samples from independently proven filicide, as opposed to those who have been convicted.

The understanding of psychosocial correlates of filicide is limited by the nature of the available studies. Psychosocial studies are often retrospective or describe post-hoc correlations with filicide. There is also uncertainty that the filicide group is correctly classified, as convictions and confessions are unreliable sources of corroboration of homicide. There is wide variation within the filicide group in terms of motivation and intent, which makes it difficult to generalise beyond the specific sample. Investigation, therefore, needs to proceed on a case-by-case basis, as there is insufficient evidence that psychosocial factors can discriminate between homicide and other deaths to trust their meaning in death investigation. As a causal relationship between psychosocial factors and filicide has not been proven, psychosocial factors have limited value in assisting the investigation of infant death. Lastly, it is probable that paediatricians dealing with child

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[432] Ibid n 8, *Anthony*.

abuse and involved in lower courts are more reliant on psychosocial correlates than pathologists. [433] As cases seen by paediatricians do not always die and are heard in lower courts, it is difficult to access evidence tendered but this is a fruitful area of inquiry or research.

Section II

Chapter 7: Experts, expertise and errors: The psychology of medical reasoning and decision-making

> *...illusions of validity[434] and skill are supported by a powerful professional culture…people can maintain an unshakeable faith in any proposition, however absurd, when they are sustained by a community of like-minded individuals.[435]*

The words of Daniel Kahneman, Nobel laureate and psychologist, are pertinent for medical experts investigating cause of infant death. It is a truism that human beings make mistakes, regardless of the extent of their experience and expertise. Medical knowledge about sudden unexplained infant death (SUDI) is complex and contradictory. Smothering/SIDS and inflicted triad/SBS deaths are relatively poorly understood. The medical determination of cause of sudden infant death is fraught with uncertainty, as the post-mortem findings are often inconclusive, there is rarely independent corroboration of events preceding death and there are many non-medical factors in the investigation context with unknown relevance to the task. Consequently, the reliable determination of cause of infant death is not an easy endeavour. Both types of cases have been associated

[433] Cordner, S, personal communication, 2013.

[434] In psychology, the term 'validity' refers to accuracy.

[435] Kahneman, D, *Thinking fast and slow* (Allen Lane, 2011) 217.

with wrongful convictions or, at the very least, medical evidence of uncertain reliability has been admitted to criminal trials, contributing to verdicts that are questionable and seem substantially unfair. Psychological processes can affect medical judgment and lead to reasoning errors, which in turn can contribute to failures in medical and legal management of medical opinion evidence in SUDI trials. These processes operate at an unconscious or subconscious level of awareness, which means they are not readily identified and corrected, as the expert might not be aware of the operation of these processes. The difficulties with ascertaining the mechanism of infant death and underlying psychological factors create conditions of uncertainty in which medical decision-making and skill development is not readily achieved.

The breadth and depth of psychological literature on expert decision-making is vast. The thesis concentrates on some expert psychological processes that might affect reliability of decision-making and acquisition of expertise: that is, the role of decision-making conditions in skill development, clinical judgment and associated cognitive errors from biases, heuristics or shortcuts, and overconfidence. Biases can create shortcuts that expedite expert information processing but also introduce sources of judgment error. Overconfidence is an unconscious bias that impacts on expert judgment and creates an illusion of evidence strength, particularly when there is no feedback about the accuracy of the expert's decision. The critical question is whether judgment errors can be detected and, ultimately, avoided. The development of reliable medical expertise and opportunity for skill development in medical investigation of the mechanism of death is limited by the rarity of these cases and the lack of independent corroboration of cause of death, which would provide feedback on accuracy. While inquiries by medical

and legal communities[436] aim to improve the quality and reliability of medical and legal judgments and decisions, the psychological literature offers frameworks for understanding the cognitive processes underpinning expertise and error. This section of the thesis examines the conditions under which expertise develops and those in which errors are more likely to occur.

7.1. Psychology of experts and expertise

Expertise consists of accurate performance in one's area of speciality with peer acceptance of skilled performance. In psychology, the concept of expertise involves accuracy and consistency (across time and between experts).[437] Broadly, there are two lines of inquiry in the psychology of expertise and error: heuristics and biases (HB), and the natural decision-making (NDM) approaches. The first, originally conceived by the late Amos Tversky and Daniel Kahneman, is the 'heuristics and biases' approach which views expert reasoning with scepticism and is particularly concerned with understanding conditions under which experts make errors.[438] Gary Klein leads the second branch of enquiry into expert thinking from a naturalistic decision-making (NDM) perspective.[439] The latter may not exalt experts, but has relatively more regard for the abilities of seasoned individuals to solve complex problems rapidly, or 'intuitively'. Both lines of enquiry have advanced understanding of how expertise develops and conditions under which it falters.

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[436] Discussed in Chapter 8: Judicial and Medical Inquiries.
[437] Accuracy replaces the psychological term validity in this chapter for clarity.
[438] Tversky, A, and Kahneman, D, 'Judgment under uncertainty: Heuristics and biases' (1974) 185 *Science* 1124–1131.
[439] Klein, G.A, Orasanu, J, Calderwood, R, and Zsambok, C.E, *Decision making in action: Models and methods* (Norwood, NJ: Ablex, 1993).

7.2 Heuristics and biases approach

HB researchers have a sceptical attitude towards expertise and expert judgment, particularly clinical judgment. They are interested in the differences between human judgment and judgments yielded by algorithms[440] constructed from the information available to the clinician. The central thrust of the HB approach is that human expert errors are caused by psychological biases and heuristics, while algorithms that apply the same information to the decision task are relatively more accurate and consistent. This section examines clinical and algorithm approaches to expert decision-making.

The HB approach arose from a seminal monograph published by Meehl in 1954.[441] Meehl retrospectively reviewed 20 studies comparing the accuracy of predictions made by professionals (mainly clinical psychologists) to that of simple statistical models. The target prediction ranged from estimates of academic success to propensity for violence. Although the algorithms Meehl developed were based only on a subset of information available to the clinicians, the statistical predictions were more accurate than human prediction in almost every case. Meehl concluded that the reason for the relative inferiority of clinical judgment was that clinicians were uncritically reliant on their intuition or 'hunch' and failed to apply elementary statistical reasoning, such as considering base rates of the target variables.[442] Not surprisingly, Meehl's conclusions have provided the impetus for decades of research in HB and ongoing interest in conditions under which experts make mistakes.

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[440] Algorithms are logical, mathematical models that apply rules to solve problems.

[441] Meehl, P.E, *Clinical vs. statistical prediction: A theoretical analysis and a review of the evidence* (Minneapolis: University of Minnesota Press, 1954).

[442] Meehl, P.E, 'Why I do not attend case conferences' In P. E. Meehl (Ed), *Psychodiagnosis: Selected papers* (Minneapolis: University of Minnesota Press, 1973) 225–302.

Subsequent research has consolidated Meehl's initial observations about some of the limitations with clinical judgment. Meehl's conclusions have been replicated across the decades since his seminal publication. For example, humans (as opposed to mathematical models) tend to reach different conclusions when given the same case information on different occasions: that is, they did not apply rules consistently.[443] A 'bootstrapped' mathematical model was actually more accurate than human expert judgment. 'Bootstrapping' refers to the process of developing a quantitative model of an expert's judgments by correlating the expert's prediction with the information the expert used to make the prediction. Bootstrapping models apply rules consistently and, hence, can yield more accurate predictions than humans. The bootstrapping effect is strongly supported by research in which the model was almost always more accurate than the decision-makers they modelled.[444] Human decision-makers (i.e. experts) have been found to be relatively more inconsistent in applying rules and were susceptible to the influence of 'noise', or irrelevant information, to the extent that substantially impairs the accuracy of their judgments. Bootstrapped models are relatively more accurate because they can detect pertinent cues even when the decision environment is confusing or provides few clear cues to assist decision- making. Clinical judgments are, however, affected by the poor quality of data available to make decisions, which in turn affects the reliability of judgments. Mathematical models perform particularly well under conditions of uncertainty where human skill development is disadvantaged by the poor environment.

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[443] Goldberg, L.R, 'Man versus model of man: A rationale, plus some evidence, for a method of improving on clinical inferences' (1970) 73 *Psychological Bulletin* 422–432.
[444] Karelaia, N, and Hogarth, R.M, 'Determinants of linear judgment: A meta-analysis of lens model studies' (2008) 134 *Psychological Bulletin* 404 – 426.

Meehl's findings also influenced Kahneman's clinical practice.[445] In the 1950's, Kahneman worked at the Psychological Research Unit of the Israel Defence Forces. Kahneman assessed candidates for officer training and had a strong sense that he knew the officers well enough to be able to accurately predict their progress in training and combat performance. This subjective (clinical or unquantified) conviction that he understood each case in isolation was not diminished by statistical feedback from officer training school indicating that the accuracy of Kahneman's assessments was negligible. Kahneman called this unjustified sense of confidence that comes with clinical judgment an 'illusion of validity' (or accuracy). Clinical judgment, which is relatively subjective, is more fallible than mathematical or statistical models that yield judgments or decisions based on all available data deemed relevant. The limitation of a mathematical model is that it is not more reliable than the data from which it is constructed. The application of mathematical models to SUDI investigation is necessarily limited by the lack of information on features that distinguish between homicide and other causes of death. Complicating the clinician's task is the fact that population prevalence or base rate data is lacking with regard to most signs associated with SUDI. The information or data that does exist relates to cases of *suspected* homicide without independent verification of the mechanism of death. SUDI investigation is also a fundamentally different task to predictions of Israeli soldiers' performance or career performance among academics. If a model cannot be constructed on existing SUDI data, a more standardised approach to making clinical judgments, based on protocols or checklists followed by all SUDI investigators, would help to reduce errors from

[445] Kahneman, D, 'Autobiography', In T. Frangsmyr (Ed), *Les Prix Nobel 2002* [Nobel Prizes 2002] (Stockholm, Sweden: Almqvist & Wiksell International, 2003).

inconsistencies typical of clinical judgment. This approach has been adopted with success in the evidence-based medicine approach to diagnosis.

7.2.1 Base rate fallacy

The 'base rate fallacy'[446] refers to an error in reasoning in which the general prevalence or frequency of an event in a given population is ignored and the specific case is thought to represent the base rate of a particular factor. For example, when making a medical diagnosis, two types of information may be available. The first, type one, is general information about the prevalence or frequency of the disease in the population. The second is specific, or type two, information about the patient based on examination or tests. Prevalence, (type one) information refers to 'base rate' data, while type two information is drawn from the specific case under examination. When the possibility of a rare disease is being considered, the 'base rate' is the rarity (hence prevalence) of the disease irrespective of any results on the specific patient being assessed. When only type one or prevalence information is available, people tend to use it to judge probabilities, which make sense as that is all there is to go on. However, when both types of information are available, people tend to make judgments of probability based on the specific, or type two, information, while ignoring the base rate, or type one, information. This is called the base rate fallacy as the prevalence/general information is ignored when it should be considered along with the specific information.

The base rate fallacy can be a significant source of error in medical decision-making in SUDI investigation. For instance, the fallacy is a particular vulnerability for

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[446] Tversky, A, and Kahneman, D, 'Evidential Impact of Base Rates', In Kahneman, D, Slovic, P, and Tversky, A, (eds) *Judgment under uncertainty: heuristics and biases.* (New York: Cambridge University Press, 1982) 153-160.

child abuse physicians required to decide whether a death constitutes homicide on the basis of the triad of injuries thought to indicate shaking death. There is often type two information (specific findings in an infant), while type one information (wider population prevalence of a particular physical sign – the base rate) is not always available. These physicians are likely to be exposed to more *possible* cases of child homicide, as that is their area of expertise. There is a risk, however, that they will *overestimate* the likelihood of homicide relative to other explanations for the presenting signs, unless base rates of the triad are considered. As the physician's sample of infants might be unusual (assuming that the vast majority of infants are not harmed or killed), an accurate diagnosis, based on the triad, depends on showing that the triad of injuries is *not* found at the same or similar rate in the wider population of same-aged infants (base rate). If the base rate does not differ from the rate in the clinical (homicide) population, then the triad might not be indicative of pathology.[447]

Following on from the previous paragraph, the challenge in determining the mechanism of death accurately is finding signs or factors that differentiate between various causes of death. For instance, it is thought that subdural haemorrhages (SDH) are indicators of shaking death. However, 46% of 'normal' (researcher's label) newborns screened at birth had SDHs.[448] If these haemorrhages persist, progress, or are complicated, neuropathic events occur, including acute or apparent life threatening events (acute, unexpected change in an infant's breathing), usually between 6 weeks and 6 months of age.[449] Unresolved haemorrhages can become chronic and the chances of

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[447] Statistical analysis – for instance, with a chi-square statistic, which can be used on categorical data – would still be necessary to demonstrate that there is a *significant* difference, beyond chance, in the prevalence of the triad in the clinical group, compared to the general infant population.
[448] Ibid n 299.
[449] Ibid n 300.

further haemorrhages are higher than in infants who have never experienced a haemorrhage. However, haemorrhages do not usually result in death. Therefore, SDH in a specific case of a young infant, especially below 6 months of age, is not necessarily an indicator of homicide (if 46% is a reliable estimate of the base rate of SDH in babies[450]). When the high base rate of haemorrhages in newborns is taken into account, shaking death is not the obvious conclusion when an infant dies suddenly and has SDHs. It is but one of many possible explanations for the observed haemorrhages. Ignoring the base rate of SDH is likely to lead to erroneous conclusions.

Another manifestation of the base rate fallacy is the weight attributed by child abuse paediatricians to psychosocial facts in SUDI cases suspected to be homicide. For instance, maternal depression, presence at the infant's bedside near the time of death, poor bonding with the deceased infant, and relationship distress are all factors seen to be 'indicators' of homicidal tendencies. The base rate – as opposed to the specific facts of a case of multiple SUDI or triad death – of each of these psychosocial variables is difficult to estimate. However, it is not the case that most depressed mothers, in distressed relationships, who are struggling to bond with their infant murder their infants, whether by smothering or shaking. These variables are common occurrences in the post-partum phase and do not reliably differentiate between mothers who have committed homicide and those who have not. They do not advance the diagnostic process unless there is evidence independent of these psychosocial factors to indicate that a death constitutes homicide. Otherwise, it is a *post-hoc* correlation of putative psychosocial risk factors associated with homicide – an approach fraught with danger of error.

[450] Further studies would need to confirm that SDH is not uncommon in babies less than 6 months of age, if the 46% figure is to be accepted as a reliable finding.

Furthermore, most of the mothers in the appellate court cases examined in this thesis were not depressed. Consequently, maternal depression may have no explanatory value in determining the mechanism of death.

7.2.2 Bayes Theorem

In examining mathematical models, it is important to consider Bayes' Theorem. The Bayesian approach to statistical inference has been the subject of controversy for decades. There has been debate over the use of Bayes' Theorem in court.[451] One criticism relates to the quantification of evidence that contains a subjective element of judgment and estimation.[452] Another criticism against the use of Bayes' Theorem in criminal law is that this might erode the presumption of innocence.[453] Importantly, a mathematical model is only as good as the data upon which it is based. This is an inherent problem with the application of any mathematical model to deciding the mechanism of death in SUDI: that is, the data available is not accurate enough to assist with determining cause of death.

Decision theory proposes that reaching a diagnosis requires updating opinion or decision-making with imperfect information (the clinical evidence). [454] The standard rule for this task is Bayes' Theorem. The prior (pre-test) probability is either the known prevalence of the disease (base rate) or the clinician's subjective impression of the probability of disease before new (clinical or case-specific) information is acquired. The

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[451] *R v T* [2010] EWCA Crim 2439; Tribe, L.H, 'Trial by Mathematics: Precision and Ritual in the Legal Process' (1971) 84 *Harvard Law Review* 1329 (constituting the main response to this approach).
[452] Ibid, Tribe, 1358–59.
[453] Ibid, Tribe, 1372–75.
[454] Hunink, M, Glasziou, P, Siegel, J, Weeks, J, Pliskin, J, Elstein, A.S, et al. *Decision making in health and medicine: integrating evidence and values*. (New York: Cambridge University Press, 2001); Sackett, D.L, Haynes, R.B, Guyatt G.H, and Tugwell, P, *Clinical epidemiology: a basic science for clinical medicine* (2nd ed. Boston: Little, Brown, 1991).

posterior (post-test) probability, the probability of disease given new information, is a function of two variables, prior probability and the strength of the evidence, measured by a 'likelihood ratio'.

The difficulty with Bayes' Theorem is that it tells us how we *should* reason, but it does not claim to describe how opinions are revised in response to new information. Nevertheless, it is likely that few clinicians use a Bayesian approach in daily practice and informal methods of opinion revision still predominate. Bayes' Theorem directs attention to two major classes of errors in clinical reasoning: in the *assessment of either pre-test probability or the strength of the evidence* – both of which are affected by the base rate. The psychological study of diagnostic reasoning from this viewpoint has focussed on errors in both components, and on the simplifying rules or heuristics that replace more complex procedures. Consequently, this approach has become widely known to fall in the HB approach to expert decision-making.[455]

Evidence-based medicine is the most recent, and, by most standards, the most successful effort to date to apply statistical decision theory in clinical medicine.[456] It teaches Bayes' Theorem, and residents and medical students quickly learn how to interpret diagnostic studies and how to use a computer-based nomogram to compute post-test (posterior) probabilities and to understand the output.[457] Similarly, surgeon and medical writer Atul Gawande argues that checklists and other approaches that ensure all

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[455]Ibid n 446; Elstein, A.S, 'Heuristics and biases: selected errors in clinical reasoning' (1999) 74 *Academic Medicine* 791-4.

[456] Sackett, D.L, Richardson, W.S, Rosenberg, W, and Haynes, R.B, *Evidence-based medicine: how to practice and teach EBM*. (New York: Churchill Livingstone, 1997). See Chapter 1, sub-section 1.1 for discussion of evidence-based medicine.

[457] Schwartz, A, *Nomogram for Bayes's theorem* (1998) <http://araw.mede.uic.edu/ cgi-bin/testcalc.pl.>

steps of a given process are clear to the expert and followed consistently is associated with increased reliability and success in medical (and other complex) tasks.[458]

7.3 Natural decision-making (NDM)

The NDM research paradigm on expertise arose out of observations of master chess players by Chase and Simon[459] and de Groot.[460] NDM researchers analysed actual experts' cognitive processes to make sense of constructs such as intuition. de Groot demonstrated that master chess players rapidly identify promising chess moves, while mediocre chess players were unable to even identify or detect the best moves. Chase and Simon found master chess players had remarkable perceptual skills with which they were able to rapidly recognise complex patterns. In fact, the researchers estimated that chess masters with over ten years' experience acquire a repertoire of 50,000 to 100,000 immediately recognisable patterns that allows them to identify promising moves without having to calculate all possible contingencies. Intuition came to be defined as the rapid recognition of patterns stored in memory.

The main aim of NDM is to demystify expert intuition by identifying the cues experts use to make their judgments, even though the cues involve tacit knowledge and are difficult for the expert to articulate. By evaluating experts who are successful (accurate) and skilled, NDM revealed insights into their decision-making mechanisms in order to induct novices into the expert task. NDM researchers use cognitive task analysis (CTA) to identify the cues and strategies used by experts.[461] CTA consists of

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[458] Gawande, A, *The Checklist Manifesto: How to Get Things Right.* (Picador, 2009).
[459] Chase, W.G, and Simon, H.A. 'The mind's eye in chess' In W. G. Chase (Ed.), *Visual information processing* (New York: Academic Press, 1973) 215–281.
[460] de Groot, A.D, *Thought and choice in chess.* (The Hague: Mouton, 1978).
[461] Crandall, B, Klein, G, and Hoffman, R.R, *Working minds: A practitioner's guide to cognitive task analysis* (Cambridge, MA: MIT Press, 2006); Schraagen, J.M.C, Chipman, S.F, and Shalin, V.J, (Eds) *Cognitive task analysis* (Mahwah, NJ: Erlbaum, 2000).

conducting semi-structured interviews aimed at eliciting cues that influence expert judgment from which inferences are made about experts' underlying judgments and decision-making processes of experts in the field.

The measure of expert judgment accuracy is different in the HB and NDM traditions. HB research compares professional judgment with the outcome of a mathematical model that makes the best possible and most consistent use of the available information. NDM research compares the target expert's performance with that of the most successful experts in their field. The latter is also called a 'normative' measure. An inherent assumption in this approach to expert behaviour is that success means that the judgment is accurate.

Klein and others extended de Groot and Simon's research to include the decision-making skills of fire ground commanders who operate under conditions of enormous uncertainty and time pressure. These commanders do not have the benefit of time to generate and evaluate sets of options, and yet they were able to make successful decisions without comparing options. Klein interviewed the commanders for hours and mapped out their thinking schema (underlying structures).[462] Klein concluded that the commanders generated one plausible hypothesis drawn from a decade of learning basic patterns through actual and virtual experience. The commanders mentally simulated this option in the situation facing them. Then the simulated actions would be modified or applied; or the next plausible hypothesis was generated until the solution that best fits the context was found.

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[462] Klein, G.A, Calderwood, R, and Clinton-Cirocco, A, 'Rapid decision-making in the fireground' (1986) 30 *Proceedings of the Human Factors & Ergonomics Society Annual Meeting* 576-580.

de Groot had also noted this phenomenon, labelling the process 'progressive deepening'.[463] Klein described a similar sequential analysis of possible actions that matched basic patterns to a stored memory bank, a process he called 'recognition-primed decision' and it worked because it utilised the commanders' tacit knowledge.[464] Similarly, Polanyi described the process of tacit knowledge as a pre-logical stage of knowing in which 'we can know more than we can tell'.[465] The recognition-primed decision model has been described in various other settings, such as offshore oil installations and military command and control, with promising results in terms of its applicability to complex decision-making situations.[466] In terms of achieving accuracy, a central purpose of expert judgment, the stored knowledge must be accurate in the first place. Otherwise errors in judgment will occur.

The difficulty with relying on the recount of thinking provided by experts in NDM research is an uncertainty as to whether the neat sequential steps inferred is actually what happens in the expert's mind during problem-solving. It may well be that the expert is providing a coherent *post-hoc* story. As memory is reconstructive, the act of repeatedly going over the event, as is the case in cognitive task-analysis, may deliver a *post-hoc* view incorporating the outcome into the expert's reasoning process.[467]

The skill or expertise of master chess players and fire commanders was based on hundreds of hours of practice these experts amassed. The acquisition of expertise is characterised by experience, practice, fine tuning, changing unsuccessful manoeuvres

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[463] Ibid n 460.
[464] Ibid n 462.
[465] Polayni, M, *The Tacit Dimension*. (New York: Anchor Books, 1967) 4.
[466] See, Klein, G.A, *Sources of power: How people make decisions.* (Cambridge, MA: MIT Press, 1998).
[467] This is a common feature of scientists' accounts of their work, whether in scientific publications or written accounts of their activities. See example, Schuster, J.A, and Yeo, R.R, (Eds), *The Politics and Rhetoric of Scientific Method* (Springer, 1986); Gilbert, N.G, and Mulkay, M.J, *Opening Pandora's Box*: *A Sociological Analysis of Scientists' Discourse*. (Cambridge University Press, 1984).

and many feedback loops, which indicate what does and does not work (no doubt there are many mistakes made along the way).[468] This is in stark contrast to the relatively limited first-hand experience paediatric forensic pathologists or child abuse paediatricians have with differentially diagnosing when an infant death constitutes homicide, as opposed to other causes. Although pathologists' knowledge and experience in other areas of pathology is important in performing their investigations, the rarity of infant homicide and lack of feedback on whether their judgments are accurate is likely to affect the nature of their experience and knowledge of SUDI investigation. NDM research shows that expertise comes from practice and refining skills over time to reach the levels of accuracy we should expect of experts. SUDI investigators, by virtue of the rarity of these deaths, have limited opportunity to learn skills and typically do not have independent verification of the accuracy of their judgments. The physicians/clinicians who qualify as expert witnesses in criminal trials for SUDI are, by these criteria of expertise, necessarily limited in the scope of their expertise and knowledge. The very nature of SUDI investigation affects their ability to develop accurate judgments, a hallmark of expertise.

7.4 Perspective of medical decision-making researchers

There is little disagreement in the psychological literature that expert reasoning and judgment consists of, at the very least, memory and information processing functions. The psychology of medical decision-making literature has two leading approaches represented by medical academics Arthur Elstein and Geoffrey Norman. Elstein has described the dominant psychological decision-making model, statistical decision

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[468] Interestingly, Malcolm Gladwell argues that expertise depends on talent and 10,000 hours of practice. Gladwell, M, *Outliers*: *The Story of Success* (Allen Lane, 2008).

theory, as 'a model of idealized rationality under uncertainty.'[469] Decisions that depart from this model are thought to be errors produced by the psychological processes of heuristics and biases. Elstein concurs with Tversky and Kahneman[470] that actual decision-making is far from the idealised model. Rather, understanding heuristics and biases is important because the idealised or statistical model is not a description of how people actually make judgments and choices under conditions of uncertainty.

Norman, on the other hand, is more concerned with understanding models used by people to match signs to categories of diagnosis. He argues that identifying cognitive heuristics and biases that violate the rules of statistical decision theory is not useful, as people are not trying to reach conclusions using these principles.[471] Norman asserts that there is little to be gained from proving that medical decision-makers do not apply algorithms to the optimal level that statistical models do, as the basis for computation people use is substantially different to algorithms.[472]

Any model of decision-making has to incorporate the possibility that there are many ways to solve medical problems and different solutions may work for different applications. While research suggests that relying on mathematical models will yield more accurate results, SUDI investigation cannot effectively use such models as there is insufficient information available on base rates of death findings and factors that differentiate between homicide and other causes of death.

7.5 The conditions for developing skilled expertise

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[469] Elstein, A.S, 'Clinical problem solving and decision psychology: comment on ''the epistemology of clinical reasoning.''' (2000) 75(10) *Academic Medicine* S134–S136.
[470] See generally, Ibid n 451.
[471] Norman, G.R, 'The epistemology of clinical reasoning: perspectives from philosophy, psychology, and neuroscience' (2000) 75(10 suppl) *Academic Medicine* S127–S133.
[472] Ibid.

The opportunity to develop reliable expertise requires the developing expert to receive ongoing accurate feedback about his or her performance, as was the case with Klein and de Groot's experts. There are two necessary conditions for skill development: environments in which there are accurate and clear cues available to guide skill development and an adequate opportunity to learn skills through repeated and proximal feedback on performance outcome. Skilled thinking or judgment has been described in the following manner:

> *The situation has provided a cue: This cue has given the expert access to information stored in memory, and the information provides the answer. Intuition is nothing more and nothing less than recognition.*[473]

The 'recognition as skilled judgment' model implies that two conditions must be satisfied for a judgment to be genuinely skilled. Firstly, the environment must provide adequately accurate cues about the characteristics of the situation. Secondly, people must have the opportunity to learn the relevant cues. Skilled judgment can only develop in an environment of sufficient regularity, which provides accurate cues about the situation: described as 'causal and statistical structure of the relevant environment.'[474] Certain tasks yield earlier cues than others: for example, an infant with an infection will have a temperature, while prediction of stock movements depends on publicly available information that could be used to predict future movements. In the latter case, if such information were available, the stock price would already reflect it. Thus, as there is more accurate or clear information easily available for the nurse than there is for the

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[473] Simon, H.A, 'What is an explanation of behavior?' (1992) 3 *Psychological Science* 150–161, 155.
[474] Kahneman, D, and Klein, G.A, 'Conditions for intuitive expertise: A failure to disagree' (2009) 64(6) *American Psychologist* 515 – 526.

stock trader, there is more reason to trust the judgment of the nurse over the trader, as the nurse has access to better information. The challenge therefore is to determine the accuracy of the environmental cues when assessing decision reliability. Some environments, such as economic or political forecasts or SUDI investigation, are problematic or 'noisy' because the environment has too many variables and the task is so complex that achieving reliable judgments is difficult.

The second necessary condition for recognition, and hence skill development, is an adequate opportunity to learn relevant cues. As indicated previously, master chess players build up a repertoire of 50,000 to 100,000 paths to advance games over several years of practice.[475] Expertise develops not only with an increasing fund of knowledge but also with many hours of repetition and practice. Even so-called creative intuitions are based on finding accurate patterns in memory, a task that some people perform much better than others.

Skilled judgments, therefore, develop in environments with clear and accurate cues in which the individual has the opportunity to learn the rules of the environment and receive feedback on accuracy. In real-life professional contexts, these conditions may not be available either because the environment is insufficiently predictable (such as long-term prediction of economic or political forecasts or SUDI investigation) or because of an absence of opportunities to learn rules. Under these conditions, experienced professionals can believe that they are correct in their judgment, called subjective confidence, even when they lack the true skill that is required to make accurate decisions. Interestingly, high subjective confidence is itself not a good indicator

[475] Ibid n 459.

of accuracy, as it may be illusory, as Kahneman discovered in his clinical practice.[476] These initial hypotheses or hunches have to be checked rationally and deliberately in order to ensure accuracy in judgment.

NDM research suggests that expert reasoning follows a sequential process of generating one plausible hypothesis at a time, which is reviewed and implemented if the expert is satisfied with the proposed plan of action. To do this, the expert needs a repertoire of knowledge and experience to generate hypotheses. In SUDI cases, the expert may well have considerable experience in detecting child abuse or conducting post-mortem examination of deceased individuals. The persistent problem for SUDI investigation is that there is very limited opportunity to gain experience, as these cases are rare and success of a diagnostic strategy is difficult to measure, as there is no independent feedback on accuracy. SUDI investigations occur in an uncertain and unclear environment, which can contribute to errors. Peer acceptance or agreement, often the only proof beyond the conviction of the individual expert, is not a substitute for independent corroboration of homicide. When deciding the mechanism of death in this environment, it is possible for experts to develop confidence in judgments that are incorrect. Such errors would affect the development of expertise. In SUDI, the task is one of uncertainty rather than time pressure and the expert will only have 'normative' feedback (that is, peer agreement or acceptance), not an independent or evidence-based measure of the accuracy of the diagnosis. This means that determining the mechanism of multiple intra-family deaths or triad deaths is the type of situation in which expertise is difficult to develop and the limited or uncertain feedback means that errors are not

[476] Einhorn, H.J, and Hogarth, R.M, 'Confidence in judgment: Persistence of the illusion of validity' (1978) 85 *Psychological Review* 395-416.

identified and corrected. If it is the case that the expert has faith in his or her methodology, it is unlikely they will be conscious of sources of unreliability in their decision-making. Other institutions, such as courts, are, in turn, unlikely to appreciate such limitations unilaterally.

7.6 The role of context on expert judgment

The preceding discussion reveals the importance of the decision-making environment on expert judgment. By definition, experts are expected to deliver judgments that are accurate and reliable. That is, to make the same correct judgment on the same data on each occasion it is judged. Ideally, experts are expected to be immune to bias and subjectivity. But in SUDI cases there is considerable uncertainty and disagreement about the interpretation of findings and no independent verification of diagnostic accuracy. In this context bias is a real risk, whether it stems from the expert's suspicion that a death constitutes homicide or overconfidence in their ability to correctly diagnose the mechanism of death.

Dror and his colleagues argue that 'being a scientist or forensic expert is rooted in the ability to examine evidence reliably and objectively'.[477] In order to do this, the expert must dissociate themselves from the extraneous contexts and other influences that interfere with their ability to assess the information upon which their opinion is based. In coming to a decision, the expert's reasoning and decision-making must be based only on the information relevant to their particular task and their interpretation of the information should be unbiased. To do this, experts have to ignore other influences in the context of a case. In SUDI investigation, medical evidence is often limited or its

[477] Dror, I.E, Charlton, D, and Peron, A.E, 'Contextual information renders experts vulnerable to making erroneous identifications' (2006) 156 *Forensic Science International*. 74 -78, at 74.

interpretation is controversial. Psychosocial factors associated with these deaths can influence a medical expert's decision-making. Psychosocial variables that are prevalent in situations other than homicide can acquire an inculpatory meaning that is unwarranted, ultimately resulting in a bias towards finding the defendant guilty of homicide. While psychosocial factors are an inevitable aspect of death investigation, medical experts need to be transparent about any reliance on these variables when forming opinions – in a way that can be made clear to courts. That is, psychosocial evidence was considered but these are its constraints or limitations when applied to mechanism of death determinations.

While development of expertise can be associated with limitations or errors, high levels of cognition are characteristic of expert information processing. Expert cognition involves both bottom-up and top-down information processing. Bottom-up refers to incoming data, while top-down relies on pre-existing knowledge.[478] Pre-existing knowledge consists of many types of mental representation, including the context in which the data is presented, past experience and knowledge, expectations and beliefs about such information. As experts rely more on pre-existing knowledge processes,[479] which enables efficient and effective processing of incoming data, there can be distortions and bias in the way that incoming data or signs are interpreted. For example, detectives and forensic experts can contaminate and bias interpretations of data due to pre-existing knowledge.[480] As experts integrate complex reasoning steps into a

[478] The words incoming information processing will replace bottom-up and pre-existing knowledge for top-down, for clarity.
[479] Dror, I.E, 'The Paradox of Human Expertise: Why Experts Can Get it Wrong' In *The Paradoxical Brain* (Cambridge University Press, 2011).
[480] Dror, I.E, 'Biased brains' (2008) 116 *Police Review* 20-23; Dror, I.E, 'How can Francis Bacon help forensic science? The four idols of human biases' (2009) 50 *Jurimetrics: The Journal of Law, Science, and Technology*, 93-110; Dror, I.E, and Cole, S, 'The vision in 'blind' justice: Expert perception,

unified set of processes, in effect a process of chunking large tracts of information, they become faster and more efficient in decision-making. This approach is particularly important for experts operating under time pressure. These operations cause automisation,[481] which facilitates the speed of expert information processing so that conscious initiation or control is not required.[482] The expert may be unaware of their reasoning steps. Automacity makes the expert's task less effortful, but it comes at a cost. The expert may not be able to explain or recall the reasons for their actions. This is problematic in forensic settings in which accountability is important. Expert performance requires flexibility and creativity, which is sacrificed with automacity.[483] It is likely that rapid pre-existing knowledge processes include context information, such as psychosocial characteristics of the accused that are part of the expert's knowledge of the case. However, there may be an unjustified cumulative effect when medical suspicion is combined with psychosocial variables that are non-specific to homicide.

A particular bias that accompanies expertise development is confirmation bias. Confirmation bias can affect the way in which an expert generates hypotheses and attends to information. Such bias can cause an expert to selectively attend to information that confirms their belief or hypothesis or on aspects of the case extraneous to the expert decision task, or other contextual factors. A consequence of the operation of

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judgment and visual cognition in forensic pattern recognition' (2010) 17 *Psychonomic Bulletin & Review* 161-167.

[481] Schneider, W, and Shiffrin, R.M, 'Controlled and automatic human information processing' (1977) 84 *Psychological Review* 1-66; Shiffrin, R.M, and Schneider, W. 'Controlled and automatic human information processing: II. Perceptual learning, automatic attending, and a general theory' (1977) 84 *Psychological Review* 127-190.

[482] Norman, D.A, and Shallice, T, 'Attention to action: Willed and automatic control of behaviour' In Davison, R, Schwartz, G, and Shapiro, D, (eds). *Consciousness and Self- regulation: Advances in Research and Theory* (New York: Plenum, 1986).

[483] Frensch, P.A, and Sternberg, R.J, 'Expertise and intelligent thinking: When is it worse to know better?' In Sternberg R.J. (ed) *Advances in the Psychology of Human Intelligence* (Hillsdale, NJ: Erlbaum, 1989) 157-188.

confirmation bias is that data consistent with the expert's belief will be weighted more highly than conflicting or disconfirming information.[484] While this expedites a decision, the risk of error is increased. Dror conducted studies in which fingerprint experts determined whether a set of fingerprints matched those from a crime scene. Unknown to the experts, they were shown fingerprints they had previously judged to match those from the crime scene, and the context was changed: for example, that someone else had confessed to the crime. Many experts contradicted their previous judgments and came to inconsistent conclusions, indicating their judgments were unreliable. Dror concluded that the experts were influenced by context cues, rather than limiting their judgment to the experimental information most relevant to their task.[485] These errors in judgment have also been identified in medical responses in critical care[486] and radiology.[487] Despite expectations that the expert will be unbiased in their decision-making, Dror argues that contextual variables can affect expert judgment as,

> *...experts specialize and adapt their cognitive processing, optimizing to certain and specific scenarios, but these changes do not always result in enhanced performance overall.*[488]

In SUDI investigation, there is typically limited physical evidence (alleged smothering) or there is disagreement about the meaning of injuries (alleged shaking/triad deaths). These cases are often characterised by evidence of psychosocial factors that are assumed to be inculpatory (such as poor bonding relationship distress). Psychosocial factors are

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[484] Ibid n 479.
[485] Dror, I.E, and Rosenthal, R, 'Meta-analytically quantifying the reliability and biasability of fingerprint expert's decision-making' (2008) 53 *Journal of Forensic Sciences* 900- 903.
[486] Patel, V.L, and Cohen, T, 'New perspectives on error in critical care' (2008) 14 *Current Opinion in Critical Care* 456-459.
[487] Potchen, E, 'Measuring observer performance in chest radiology: Some experiences' (2006) 3 *Journal of the American College of Radiology* 423-432.
[488] Ibid n 479.

extraneous contextual cues not directly relevant to the medical expert's task of identifying the mechanism of death. The Australian pathologist, Cordner, cautions medical experts not to venture outside their expertise by interpreting the meaning of psychosocial factors.[489] Psychological research supports the need for experts to be aware of potential biasing effects of context variables such as psychosocial factors and to limit their decision-making on mechanisms of death to the medical evidence at hand.

Dror suggests that one strategy for overcoming expert vulnerability to confirmation and contextually driven bias is to rely on computers to conduct elements of the expert's task – again the use of algorithms/mathematical models.[490] In terms of fingerprint analysis, Dror and colleagues suggest that moving cognitive processes to technology is a potential solution to the risks of bias and cognitive overload in expert judgment.[491] Algorithms appear to be more reliable than clinical judgment as rules for decision-making are applied consistently. There is a place for standardisation in medical judgment, as shown by developments in evidence-based medicine. However, the challenge for SUDI investigation is the lack of data on accurate indicators of mechanisms of death and base rates of autopsy findings for homicide in the infant death population. The paucity of this information means that at this stage SUDI is not easily transformed into an algorithm or computerised decision-making. However, consistent application of decision rules, ignoring irrelevant contextual information, and conducting more extensive medical tests may assist in increasing the accuracy and reliability of

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[489] Ibid n 28.
[490] Dror, I.E, and Harnad, S, 'Offloading cognition onto cognitive technology' In Dror I.E, and Harnad, S, (Eds), *Cognition Distributed: How Cognitive Technology Extends Our Minds* (Amsterdam: John Benjamins Publishing, 2008).
[491] Dror, I.E, and Mnookin, J, 'The use of technology in human expert domains: Challenges and risks arising from the use of automated fingerprint identification systems in forensics' (2010) 9 *Law, Probability and Risk* 47-67.

SUDI investigation. Simple, standardised checklists would also assist in ensuring all data relevant to determining the mechanism of death is collected and analysed.

7.7 Overconfidence errors and expertise

Kahneman's confidence in the accuracy of his clinical judgment, despite feedback from statistical analysis that he was incorrect, is an underlying factor that contributes to expert overconfidence. Overconfidence in medical decision-making is a growing area of interest, especially in clinical decision-making, as the medical community is increasingly concerned with identifying and preventing errors in medical judgment.[492] While psychological research into accuracy has demonstrated that experienced experts perform better that novices, such as medical students, their confidence is not always related to accurate judgment, as correlations between accuracy of judgments and the confidence experienced are not consistently high.[493] It is thought that subjective confidence is determined by the extent to which the information fits the expert's beliefs, rather than whether the information is accurate.[494] That is, if the case information is consistent with the expert's hypothesis or developing narrative, experts can become unjustifiably confident in opinions or judgments based on evidence that they do not realise is flimsy or redundant. Kahneman and Klein observed that:

> *These judgments will be presented too assertively to others and are likely to be believed more than they deserve to be. The safe way to evaluate the probable accuracy of a judgment … is by*

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[492] Croskerry, P, and Norman, G, 'Overconfidence in clinical decision-making' (2008) 121 *The American Journal of Medicine* S24–S29.
[493] Arkes, H.R, 'Overconfidence in judgmental forecasting' In Armstrong J.S (Ed), *Principles of forecasting: A handbook for researchers and practitioners* (Boston: Kluwer Academic, 2001) 495-516; Griffin, D.W, and Tversky, A, 'The weighing of evidence and the determinants of confidence' (1992) 24 *Cognitive Psychology* 411–435.
[494] Ibid n 476; Kahneman, D, and Tversky, A, 'On the psychology of prediction' (1973) 80 *Psychological Review*, 237–251.

considering the validity[495] *of the environment in which the judgment was made as well as the judge's*[496] *history of learning the rules of the environment.*[497]

This suggests that expert judgment cannot be assumed to be accurate merely because the expert is confident in his or her belief. Determining the accuracy of the expert's judgment depends on the reliability and relevance of the information upon which the judgment is based. Consequently, experts providing opinion evidence to courts need to advise the court of the basis of their conclusions and the limitations of their data and opinion. Confidence can convey erroneous signals of accuracy or reliability about which the expert might be unaware.

An associated aspect of expert performance is that professionals, especially physicians and nurses, have expertise in some of their activities and not others.[498] Physicians perform tasks that are constant in the sense that there is a standard process but the diagnostic dilemmas are unfamiliar. The ability to recognise that a situation is anomalous and poses a novel challenge is at the core of real expertise. Descriptions of expert medical diagnostic ability focus on the ability of some physicians to realise the signs in a particular case do not match any familiar category and to commence a deliberate and effortful search for the true diagnosis.[499] That is, these clinicians switch to analytical, slow processing after the faster, recognition-memory match task fails. Klein has proposed that one possible explanation for experts (and clinicians) having an illusion of accuracy is that they may believe that because they have skill in one area, the

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[495] i.e. Accuracy.
[496] i.e. Expert's.
[497] Ibid n 474, 522.
[498] Shanteau, J, 'Competence in experts: The role of task characteristics' (1992) 53 *Organizational Behavior and Human Decision Processes,* 252–262.
[499] Ibid n 458; Groopman, J, *How doctors think* (New York: Houghton Mifflin, 2007).

same skills will be successful in another area.[500] Expert subjective confidence is therefore not a good indicator of judgment accuracy and, indeed, experts who do not appreciate this can assert their opinion far more definitively than is warranted. It is possible that experts who rely on subjective confidence in clinical judgment are not actually engaging in effortful, rational thinking, which would uncover errors or lack of knowledge. Under these conditions experts may be over-reliant on the very type of cognitive process that is fallible: their own confidence or belief in their judgment accuracy. SUDI investigation is the type of expert judgment situation where overconfidence, or at least a disparity between the actual evidence (and conclusions that can be drawn from it) and expert confidence in their belief/diagnosis, is a particular danger, as the expertise context does not provide independent feedback on the accuracy of the expert's decision.

When the environment offers few reliable and accurate cues or has confusing cues, algorithms outperform clinicians in terms of accuracy, as humans may be misled by their own illusions of accuracy of judgment in these conditions.[501] However, the quality of information about base rates and identifiers of homicide limit the benefits of algorithms for SUDI investigation. Statistical or mathematical analysis has two advantages over human judgment when available cues are weak or uncertain: it is more likely to detect weak cues of accuracy that can assist in decision-making, and an algorithm will maintain above-chance accuracy by simply using such cues consistently. Given the limited discriminatory identifiers and information on sign base rates in SUDI investigation, it is not surprising that mathematical modelling has not been applied to

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[500] Ibid n 466.
[501] Grove, W.M, Zald, D.H, Lebow, B.S, Snitz, B.E, and Nelson, C, 'Clinical versus mechanical prediction: A meta-analysis' (2000) 12 *Psychological Assessment* 19–30.

determine the cause of multiple intra-family SUDI or triad deaths. Indeed the very argument likely to be raised by clinicians - that determining the mechanism of death is too heterogeneous and complex to use algorithms - is the very reason for adopting such an approach. Based on psychological research on expert judgments, algorithms are likely to outperform clinicians in this context, which is complex and uncertain. The core challenge for medicine is to conduct prospective research that would yield information on base rates and variables that distinguish between homicide and other causes of death. In the meantime, standardised investigation protocols adopted internationally would build a database and, ultimately, help to reduce the 'noise' or unreliable cues in SUDI investigation.

There is evidence of medical overconfidence in medical practice from two sources using autopsy findings as the measure of accuracy. Podbregar and colleagues[502] studied 126 patients who died in the ICU and underwent autopsy. Physicians were asked to provide the clinical diagnosis and also their level of certainty: level one represented complete certainty, level two indicated minor uncertainty, and level three designated major uncertainty. The rates at which the autopsy showed significant discrepancies between the clinical and post-mortem diagnosis were essentially identical in all three of these groups. Specifically, clinicians who were 'completely certain' of the diagnosis ante-mortem were wrong 40% of the time.[503] Landefeld and colleagues reported similar findings[504]: the extent of physician confidence showed no correlation with their ability to predict the accuracy of their clinical diagnosis. Additional direct evidence of

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[502]Podbregar, M, Voga, G, Krivec, R, Skale, R, Pareznik, R. and Gabrscek, L, 'Should we confirm our clinical diagnostic certainty by autopsies?' (2001) 27(11) *Intensive Care Medicine* 1750 – 1755.
[503] Ibid.
[504] Landefeld, C.S, Chren, M.M, Myers, A, Geller, R, Robbins, S, and Goldman, L, 'Diagnostic yield of the autopsy in a university hospital and a community hospital' (1988) 318 *New England Journal of Medicine* 1249–1254.

overconfidence has been demonstrated in studies of radiologists given sets of 'unknown' films to classify as normal or abnormal. Potchen[505] found that diagnostic accuracy varied among a cohort of 95 board-certified radiologists: the top 20 performers had an aggregate accuracy rate of 95%, compared with 75% for the bottom 20. Yet, the confidence level of the worst performers was actually higher than that of the top performers. These results confirm Kahneman's experience that his clinical judgment confidence was an illusion of accuracy, rather than being reliable.

7.7.1 The relationship between overconfidence and heuristics

Heuristics are cognitive short cuts that can facilitate decision-making, especially under time pressure. Heuristics essentially provide a set of rules that can be easily applied to make complex tasks simpler. In many situations using heuristics may result in accurate predictions, and so reflect a highly adaptive and efficient response to decision-making in the real world. Indeed, the original HB approach asserted, 'In general, heuristics are quite useful, but sometimes they lead to severe and systematic errors'.[506] HB researchers would say that judgments arising from heuristics are less trustworthy than those arising from specific experiences, rather than being wrong *per se*. Studies of medical decision-making have confirmed the existence of heuristics or biases identified by Tversky and Kahneman. Two biases relevant to medical decision-making in SUDI are representativeness and confirmation biases.[507]

The representativeness heuristic or bias refers to a situation where probabilities are evaluated by the degree to which the given sample matches, or is representative of,

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[505] Ibid n 487.
[506] Ibid n 446, 1124.
[507] Ibid n 492; Guthrie, C, Rachlinski, J.J, and Wistrich, A.J, 'Blinking on the bench: How judges decide cases' (2007) 93 *Cornell Law Review* 1–43.

a class or sample population. Using this heuristic can cause errors in medical decision-making in several different ways, many of which occur in response to problems in statistical reasoning.[508] A common medical judgment error is failing to take into account the base rate of events, if the information is presented in terms of probabilities. Other examples include ignoring the effect of sample size on the validity of the predictions; being insensitive to the reliability of information; and overweighting irrelevant diagnostic information (that is, placing undue weight on information that is unrelated to the judgment). Judgment confidence is based on the similarity of the case to a population, making the expert more confident about a 'good fit'. However, the recognition might be wrong in confusing judgment environments in which the reliability of the cues is unclear.

As discussed, confirmation bias refers to the tendency to overemphasise evidence or data that supports an existing hypothesis rather than data that refutes or disconfirms that hypothesis. Some individuals are overly confident in their conclusions and unable to adopt a more sceptical stance and look for disconfirming evidence to challenge their assumptions.[509] This bias is one of the most powerful of the cognitive biases. One reason for this may be that it takes considerably more cognitive effort to consider evidence or data that disconfirms one's hypothesis than that which confirms it. Overconfidence appears to be related to the amount and strength of supporting evidence people can find to support their viewpoints, with greater weight being given to information consistent with their hypothesis.[510] This suggests that even if the supporting

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[508] Hall, K.H, 'Reviewing intuitive decision-making and uncertainty: the implications for medical education' (2002) 36(3) *Medical Education* 216–224.
[509] Nickerson, R.S, 'Confirmation bias: a ubiquitous phenomenon in many guises' (1998) 2 *Review of General Psychology* 175–220.
[510] Koriat, A, Lichtenstein, S, Fischoff, B, 'Reasons for confidence' (1980) 6 *Journal Experimental Psychology* 107–118.

evidence is not strong, a hypothesis in which an expert is confident can appear to have stronger support than it actually has. Therefore, confirmation bias can lead to unjustified overconfidence. In one study, people's judgments were better calibrated (there was less overconfidence) when they were instructed to take account of disconfirming evidence. In some areas of medicine, adopting the opposite hypothesis strategy appears to be one of the more effective de-biasing strategies. Arguably, in forensic settings, such strategies are already incorporated into some forensic science approaches (such as those involving mathematical ratios) and judicial directions and warnings, with unpromising effect. It may nonetheless be possible to teach medical experts dealing with SUDI investigation to more actively pursue alternate hypotheses and more extensive medical investigations before assigning the mechanical cause of death.

Overconfidence then appears to be related to the amount and strength of evidence that can be found to support one's viewpoint.[511] People's judgment was less overconfident when they were required to take into account disconfirming evidence.[512] The *consider-the opposite* thinking strategy is an effective means of reducing error due to overconfidence stemming from hindsight and confirmation biases. The biased way in which people generate evidence when developing a belief or hypothesis seems to lead to overconfidence. In the SUDI context, where such deaths are rare in the context of numerous causes of death, confirmation bias in gathering evidence is a likely vulnerability as an expert's investigations would be driven by their own and their peer group's views on SUDI. However, relying on the judgments of other clinicians' conclusions about the mechanism of death, despite those judgments not being

[511] Ibid.
[512] Ibid.

independently corroborated, is likely to cause reasoning errors. In SUDI investigations, overconfidence is particularly troubling, as the investigative context does not provide reliable and accurate feedback about judgments. One solution is to conduct an exhaustive series of tests of all known conditions, regardless of how rare these conditions are, and thereafter conclude that there is no known medical reason for the death, rather than the death must constitute homicide.

The most influential and misleading heuristic in multiple SUDI investigations is Meadow's Law, which relates to multiple SUDI within a family. Meadow's Law has no evidential basis and incorrectly simplifies the complex and confusing task of determining the mechanism of death in a family. As an eminent child protection paediatrician and expert proffered it, this heuristic was met with widespread acceptance until Meadow was investigated by the GMC after providing improper statistical evidence at Sally Clark's trial. Meadow's Law conceals the fact that there is no independent or objective way of proving such an assertion nor does it convey to the court that there is rarely any physical evidence or evidence of any kind of deliberate smothering, apart from the suspicions of certain experts that the deaths constitute homicide. Heuristics based on replicable facts are useful and help clinical decision-making. Heuristics based on myths reduce the worth of the medical expert's evidence at trial and arguably mislead the court.

7.8 The role of experience in expertise

Arguably, there is a difference between clinicians with many years of experience and those whose judgments are accurate and reliable. However, the distinction between experienced clinicians and clinicians with superior performance has received relatively little attention among researchers of medical expertise, except in one notable exception,

a review paper by Mylopolous and Regehr.[513] The authors argue that contemporary researchers have assumed that novices eventually become experts. That is, more experience inevitably leads to the development of a greater (or better) resource base to form judgments, suggesting that expertise is an automatic and inevitable consequence of experience. By contrast, Mylopolous and Regehr propose that this assumption is only true for *some* experts who are skilled in executing routine procedures ('routine' experts), but that there are other experts ('adaptive' experts), who continue to evolve in their expertise only by deliberately engaging in 'progressive problem solving that consists of the continual re-investment of cognitive resources into creating not merely better performance, but in fact better understanding [of] the problem of their domain.'[514] The authors conclude that current medical education trains routine experts and that new directions are necessary to train adaptive experts.

Recent reviews and meta-analyses of thousands of experienced health professionals show weak or non-existent correlations between performance on representative tasks and years of professional experience after the completion of education.[515] In fact, for many types of performance there is a negative correlation with years of experience, which might be due to a decay in previously acquired skills,[516] or

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[513] Mylopolous, R, and Regehr, G, 'Cognitive metaphors of expertise and knowledge: prospects and limitations for medical education' (2007) 41 *Medical Education* 1159–65.
[514] Ibid n 510, 1162.
[515] Choudhry, N.K, Fletcher, R.H, and Soumerai, S.B, 'Systematic review: the relationship between clinical experience and quality of health care' (2005) 142(4) *Annals of Internal Medicine* 260–73; Ericsson, K.A, 'Deliberate practice and the acquisition and maintenance of expert performance in medicine and related domains' (2004) 10 *Academic Medicine* 70–81; Ericsson K.A, Whyte, J, and Ward, P, 'Expert performance in nursing: reviewing research on expertise in nursing within the framework of the expert-performance approach' (2007) 30(1) *Advances in Nursing Science* 58–71.
[516] Wallsten, T.S, 'Physician and medical student bias in evaluating information' (1981) 1 *Medical Decision Making* 145-64; Bergus, G.R, Chapman, G.B, Gjerde,C, and Elstein, A.S, 'Clinical reasoning about new signs in the face of pre-existing disease: sources of error and order effects' (1995) 27 *Family Medicine* 314-20; Barrows, H.S, 'Problem-based, self-directed learning' (1983) 250 *Journal of the American Medical Association* 3077-80.

an ongoing unjustified overconfidence based on inaccurate and unreliable data and reasoning.

Notably, criminal courts rely on formal qualifications and experience for admission of medical opinion evidence.[517] If the years of education undertaken to attain formal qualifications and subsequent experience does not consist of feedback on accuracy of judgments or opinions, these factors are unlikely to promote or indicate skilled, reliable expertise. When medical opinion is based on suspected, not independently corroborated homicide, there is a danger that resultant expert opinion will mislead the trier-of-fact, thereby impeding an accurate determination of the charges before it, a cornerstone of criminal trial procedure and values. Also, the criminal trial is not a systematic 'trial' or form of feedback about the reliability of medical opinion evidence, despite reliance by some experts on convictions as proof of homicide.

7.9 Conclusions

This chapter examined factors associated with development of expertise and the psychological conditions under which errors occur. Expertise develops via a process of trial and error through which the expert develops a 'database' of knowledge and effective, accurate decision-making strategies. The expert's task environment is highly correlated with acquisition of expertise. Environments that provide cues that are uncertain and confusing, and feedback on accuracy is delayed or non-existent, do not foster genuine expertise. Under these conditions, mathematical models based on information available to the expert tend to be more accurate. The main reason that algorithms are reliable is that they apply rules consistently, are less vulnerable to

[517] See Chapter 9 on Law of evidence for discussion.

irrelevant cues than human experts, and are able to detect salient cues in a confusing or, in psychological terms, 'noisy' decision environment. However, in SUDI investigation, both clinical and algorithmic decision-making are disadvantaged by the lack of information on the accuracy of diagnosis, sign specificity to homicide and base rates of differentiating signs. One solution would be to have standardised protocols or checklists that all medical investigations must follow, along with a commitment to exhaustive investigations of rare conditions. If no known cause is found, this needs to be acknowledged by the expert, rather than assuming the evidence indicates homicide.

SUDI investigation is a poor environment to develop reliable expertise, particularly as there is no independent means of verifying the accuracy of clinicians' judgments. There is no direct consequence for errors, as there is for medical judgment based on clinical opinion in clinical settings: that is, the patient improves or worsens. In SUDI, peer review or 'normative' validation or corroboration is the basis of knowledge acquisition, which is only effective if feedback on judgments is accurate. (Being associated, however, with a wrongful conviction ought to serve as a strong source of feedback on performance). As the previous discussion suggests, human judgment is prone to error due to psychological biases when the decision context provides confusing or uncertain cues, so the reliance on agreement with other experts in SUDI investigation might not promote skilled decision-making. These biases could conceivably affect all experts who reach a consensus or normative viewpoint, without accurate feedback whether the diagnosis is correct. Peer agreement is not a reliable substitute for independent corroboration of the mechanism of death. Yet medical experts and the appellate courts have favoured medical opinions that conform to the majority of medical opinion, rather than evaluating whether the content of conflicting medical expert opinion

is reliable.[518] This is troubling as improving the accuracy of medical opinion evidence on the mechanism of death depends on medical experts engaging in analytical and rational processing of case evidence. Deferring to consensus to corroborate their medical decision possibly creates an illusion of accuracy derived from agreement, rather than the strength of supporting evidence. A logical approach is likely to conclude that, in the current state of medical knowledge on determining the mechanism of death, often the medical experts cannot explain *how* an infant or infants died. This type of conclusion takes into account the limitations of medicine to explain SUDI and is a more accurate interpretation of investigative findings in some infant deaths. There is also a problem with double counting in mechanism of death determinations: that is, psychosocial factors influence medical opinion and is seen to corroborate it when the two are not independent of each other in decision-making terms. However, experts can overcome bias if they gather more information, especially on rare conditions, rigorously examine alternative hypotheses, and be willing to conclude that cause is unknown unless there is conclusive proof of homicide.

A central feature of reliable expertise is hundreds of hours of training, feedback on accuracy and accretion of an extensive knowledge base. When a SUDI investigation is viewed in light of ideal expertise development scenarios, it is clear that multiple SUDI or triad death investigations do not afford clinicians the opportunity to develop real expertise that would lead to accurate and reliable determinations of the mechanism of death. Multiple SUDI or triad deaths are rare, difficult to understand, do not yield conclusive test results to guide decision-making, and have many (often irrelevant) psychosocial attributes. Under these conditions, it is unlikely that actual expertise can

[518] See Section Chapter 9 for discussion of reliability and admission of expert evidence.

develop and the dangers of unjustified or overconfidence is a real possibility. Expertise in similar areas is insufficient to overcome the challenges to developing expertise, as expertise in one area is not necessarily relevant to other practice areas, no matter how similar.

Medical reasoning in SUDI is primarily a form of clinical judgment and is subjective, despite medical tests being physical in nature. Clinical judgment is problematic as it is vulnerable to inconsistent application of decision rules and there are problems with assigning appropriate weight to different forms of evidence. This means that clinical judgment can vary between assessments. Research comparing algorithms or mathematical models to clinical decision-making has shown that algorithms apply decision rules more consistently than do clinicians. While some clinicians would argue that algorithms are reductionist and cannot possibly take into account the many variables involved in decision-making, research has shown that the more uncertain or confusing the task, algorithms are better placed to provide reliable decisions because they will consistently apply decision rules and pick up cues that are not obvious to clinicians.

Algorithms are more consistent in application of decision rules. However, equations depend on accurate base rate information of which there is limited, if any, relating to SUDI and discriminating between accidental, natural and homicide deaths. The critical problem with SUDI investigation is the lack of independent measures of diagnostic accuracy. This affects the development of expertise, as well as techniques to uncover the mechanism of death. Overall, opinions on cause of multiple SUDI or triad deaths should be couched in cautious terms with acknowledgement that expertise is hard to come by with this type of investigation; overconfidence should be avoided; and consideration be given to saying the expert does not know how the infant died. That would be more consistent with the current medical knowledge base in SUDI

investigation. While developing algorithms to enhance the accuracy and reliability of decision-making is empirically justified, the available knowledge on SUDI is insufficient to construct algorithms, lacking as it does reliable indicators of homicide and base rates of signs of infant death from homicide. The adoption of standardised investigative methodology, such as checklists or protocols,[519] better regulation and accreditation of medical experts dealing with SUDI in forensic settings and perhaps the exclusion of some speculative opinions from the trial are ways in which the current challenges faced by medical experts in this area might be addressed. Consequently, despite its potential benefits, it is difficult to see how an algorithm could be constructed for SUDI investigation.

Psychological sources of judgment error can be managed to some degree by strict reliability standards being imposed on medical opinion evidence admitted to a criminal trial. Medical education and regulations can help to address these concerns as well. However, the correction of these sources of error depends, in a large part, on the expert's ability to identify and correct thinking distortions. Medical experts in SUDI investigation are likely to be vulnerable to overconfidence in their opinions and have an illusory sense that their confidence is based on evidence strength, rather than the potential representative and confirmation biases that interfere with accurate decision-making. In death investigation, pathologists do confer and the report produced is reviewed to determine of the opinion is reasonable.[520] Thereafter, the report is that of the individual pathologist for which he or she is responsible. However, there is a risk that agreed interpretations in death investigation might be wrong even if it appears

[519] See Chapter 8 for recommendations to this effect in the various inquiries.
[520] Cordner, S, Personal communication, 2013.

reasonable to the reviewing pathologist. That is, peers can and do agree on ideas that are later proven incorrect, a particular risk if there is insufficient critical analysis of the basis of their interpretations. The decades long belief that the triad is irrefutable proof of shaking, and hence homicide, being an example of incorrect decision-making supported by peer agreement.

Expertise in one area does not automatically generalise to all cases the expert encounters. Experience in paediatrics and pathology does not necessarily mean that the expert has well-developed skills in determining the cause of multiple intra-family SUDI or triad deaths. As a result, experts may not know the boundaries of their expertise and inadvertently proffer opinions about cases in which they have limited or no expertise.[521]

Context also influences expert judgment. When the mechanism of death is not identified, the pathologist concludes that the deaths were unexplained or unascertained, and suspicions of homicide may be raised. Extraneous contextual factors not directly relevant to the medical judgment of the mechanism of death, including psychosocial variables such as substance abuse or relationship problems, can influence medical reasoning when it ought not to do so. Expert judgment is expected to be unbiased and objective, but context and intra-psychic factors in the expert influences expert reasoning. Case information impacts on medical judgment, despite being outside the province of medical decision-making in autopsies. Evidence-based decisions are essential in expert decision-making. This comes from focussing only on the data relevant to the task (such as, autopsy and histopathology results), while ignoring irrelevant information to protect from bias due to extraneous influences. Medical expert opinion in SUDI cases is derived from physical evidence but experts have likely been influenced by contextual factors,

[521] See generally, Ibid n 474.

such as psychosocial characteristics of the accused or the family. As Cordner argues, contextual information is important but is not within the province of the pathologist,[522] especially when it is controversial or not related to the autopsy. An objective medical opinion, then, should be based on medical data only. But in SUDI cases there is considerable uncertainty and there is disagreement about the interpretation of findings. This is the context in which bias is a real risk, whether it stems from the expert's suspicion that a death constitutes homicide or overconfidence in their ability to correctly identify the mechanical cause of death. One possibility would be to ensure experts are not aware of other case information before generating their initial opinion. Thereafter, any changes of opinion based on the additional case facts could be explained by the expert and there would be clarity about their reasoning and the basis for changes in their opinion. This would be particularly instructive in multiple intra-family SUDI in which, as the earlier discussion of these trials suggest, medical opinion on the mechanism of death changed from uncertain or undetermined causes to high levels of suspicion that the deaths constituted homicide, seemingly on the basis that several sudden, unexplained deaths inevitably mean homicide.

[522] Ibid n 28.

Section III

Chapter 8: Judicial and medical regulatory responses to SUDI failures of medical opinion evidence

The previous sections described the difficulties inherent in determining the reliability and accuracy of medical opinion evidence in SUDI investigation. The challenge is substantial, as there is disagreement between medical experts about evidence that constitutes proof of homicide. Some experts believe mechanism of death conclusions based on clinical reasoning, or relatively subjective belief, based on experience, are reliable. Others are more cautious and accept that clinical opinion evidence can raise suspicions but are not, alone, definitive proof of the mechanism of death. These medical experts question whether current medical knowledge, be it clinical or other types, can unequivocally identify the mechanism of death and do not support reliance on non-medical evidence to confirm cause of death, as that is not within their area of expertise. Pathologists, such as Australian forensic pathologist Cordner, have advocated for interpretive caution and a willingness to concede the mechanism of death is unknown.

This chapter examines judicial and medical regulatory responses to unreliable medical opinion evidence proffered by child protection paediatricians and paediatric pathologists in criminal trials for SUDI. The ramifications of these inquiries are far-reaching and apply to all medical experts, not only those who were the subject of investigations. If medical and legal communities are to rectify the problems identified in SUDI investigation and prosecution, a wide-ranging multinational, multidisciplinary response is required that overhauls the way medical experts conduct and report their investigations and legal management of medical opinion evidence in criminal trials for SUDI. The controversial issue is whether medical opinion evidence on the mechanism

of death is reliable or accurate. These inquiries have not clearly articulated *how* to distinguish between reliable and unreliable medical opinion evidence. Many of the recommendations focus on transparency and accountability but whether these processes will assist in achieving reliability is unclear. A concerning element in the future is whether legal systems will be willing and able to restrict medical opinion to evidence that is demonstrably reliable, rather than medical or non-medical evidence of uncertain value. The problem is that both paediatric forensic pathologists and child protection paediatricians operate in conjunction with other systems, such as health, welfare, and law. These associations are likely to expose the medical expert to related but potentially irrelevant non-medical information that can (wrongly) influence their conclusions on the mechanism of death.

The chapter is divided between inquiries in the United Kingdom and Ontario, Canada. The UK inquiries relate to the General Medical Council (GMC) [523] investigations of the professional conduct of Meadow, Southall and Williams, all paediatricians; a review of all infant death cases by Goldsmith[524] after the Clark and Cannings appeals were successful; and the Kennedy [525] investigation of SUDI. In Ontario, Canada, the Goudge Inquiry[526] was established to assess the conduct of Charles Smith, a paediatric pathologist, who was also the subject of a civil suit by Louise

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[523] Jones, S, 'Meadow faces GMC misconduct hearing' *The Guardian* (online) 23 April 2005 <http://www.guardian.co.uk/society/2005/apr/23/NHS.childprotection>; Collins, M.J, 'Professor Sir Roy Meadow v General Medical Council EWHC' *BBC news* (online) 17 February 2006 <http://netk.net.au/Articles/MeadowWinsAppeal.asp>; 'Profile: Professor David Southall' *BBC news* (online) 6 August 2004 <http://news.bbc.co.uk/1/hi/health/3542880.stm>; 'GMC probes Munchausen's doctor' *BBC news* (online) 3 March 2004 <http://news.bbc.co.uk/1/hi/health/3528479.stm>; 'Paediatrician faces GMC hearing' *BBC news* (online) 7 June 2004 <http://news.bbc.co.uk/1/hi/health/3782957.stm>; Williams: http://netk.net.au/Williams/Williams2.asp

[524] Ibid n 351, Goldsmith.

[525] Ibid n 13, Kennedy.

[526] Ibid n 13, Goudge.

Reynolds, a mother wrongfully charged on the basis of his evidence.[527] Smith was later the subject of disciplinary proceedings and eventual deregistration.[528]

Charles Smith's comments to the Goudge Inquiry starkly portray his misperception of his role as forensic expert, which, in all likelihood, is shared by some medical experts who provided testimony in SUDI trials:

> *In the very beginning when I went to court…I honestly believed it was my role to support the Crown attorney. I was there to make a case look good…it took me a long time, years to acknowledge that it was not my role…to make the Crown's case, or to make the case of whoever wanted me in court, but really to be much more impartial.*[529]

Smith made these comments on the first day of testimony to the Inquiry, admitting his expert opinion led to innocent parents being wrongly accused of homicide, and, in some cases, incarcerated on the basis of his (unreliable) interpretations of death investigation results.

The Goldsmith, Kennedy and Goudge Inquiries are particularly instructive as both outline similar measures for professionalising forensic pathology and paediatric forensic pathology and their foundations. While the Kennedy report touches on child protection paediatricians, this aspect of child death investigation has not been as extensively investigated as forensic pathology and paediatric forensic pathology. The chapter follows developments chronologically as this illustrates the shift that has taken place from medical opinion evidence of homicide being virtually unchallenged in courts, especially pro-prosecution opinion, to increasing concern about its reliability and

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[527] *Reynolds v Kingston Police Services Board* 2007 ONCA 166.
[528] The Discipline Committee of The College of Physicians and Surgeons of Ontario, [*Available at* http://www.cpso.on.ca under Smith CR].
[529] Transcript of the evidence of Charles Smith January 28, 2008 *The Inquiry into Pediatric Forensic Pathology in Ontario* 181-182.

accuracy in SUDI investigations and prosecutions. Medical investigation of SUDI is now being critically examined in a similar vein to other specialities in the era of evidence-based medicine. The Goudge Inquiry will be examined in detail, as it addresses some of the concerns about medical opinion evidence raised in the appellate cases previously discussed.

8.1 Medical regulatory responses to *Clark*

8.1.1 General Medical Council

8.1.1.1 Meadow

Sally Clark was released from jail in January 2003. In 2005, her father, Frank Lockyer, a former senior police officer, made a complaint about Roy Meadow to the Fitness to Practice Panel (FPP) of the General Medical Council (GMC), which regulates the conduct of medical practitioners in the United Kingdom. The essence of the complaint was evidence given by Meadow to criminal courts was misleading, particularly that his inappropriate reliance on statistics might have unduly influenced the jury's verdict.[530] The GMC found serious professional misconduct was proven and ordered Meadow's name to be deregistered.[531] Clark was unusual as she and her husband were lawyers, and her father was a senior police officer. Therefore, she had access to relatively greater resources, influence and authority than mothers such as Cannings, Anthony and Kai-Whitewind. Clark's successful appeal was followed by medical opinion evidence coming under scrutiny by legal and medical authorities. Clark's father and husband uncovered evidence undisclosed by the pathologist, Williams, leading to her conviction

[530] Ibid n 523, Jones.
[531] Ibid n 523, Collins.

being quashed. These events suggest that those individuals without recourse to resources are systematically or structurally disadvantaged.

The GMC ruling led to outrage from paediatricians, including Professor Alan Craft, President of the Royal College of Paediatrics and Child Health.[532] Professor Craft warned the GMC of the implications of Meadow being deregistered, primarily that paediatricians were increasingly reluctant to provide forensic reports and testimony, and to take positions involving child protection responsibilities.[533] These responses suggest errors or professional misconduct should be overlooked, or interpreted sympathetically, in order to retain medical experts in legal responses to child protection and homicide. However, experts have a duty to the court, and arguably their professional regulatory bodies, to provide evidence that is reliable, accurate and based on their expertise. When experts err by misleading the court, whether inadvertently or not, it is reasonable that their regulatory bodies intervene to manage their conduct – irrespective of whether the purpose is child protection or fairly prosecuting homicide. A high value should be placed on reliability and accountability of opinions if parents are to be treated fairly. Similarly, the removal of children from parents is a very serious intervention by the state. It ought to be investigated when there is reliable evidence of potential harm. It is worth noting that there are often wider system failures underlying the apparent failures of individuals. Addressing medical and legal systems and their role in wrongful convictions is equally as important as dealing with individual participants in the process.

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[532] Williams, C, 'United Kingdom General Medical Council fails child protection' (2007) 119 *Pediatrics* 800–2.
[533] Kmietowicz, Z, 'Complaints against doctors in child protection work have increased five-fold' (2004) 328 *BMJ* 601.

Meadow appealed the GMC decision in the High Court, which adopted a similar view to Craft. In February 2006, Collins J, ruled against the decision to strike Meadow from the medical register,[534] concluding, while the GMC's criticism of Meadow was justified, his actions did not constitute 'serious professional misconduct'. Collins J clarified the jurisdiction of the GMC and the extent to which immunity would be provided to experts providing forensic testimony. He stressed expert evidence given in good faith would provide the expert with immunity from civil suits.[535] He also emphasised the importance of expert evidence in the justice system, the expert's overriding duty to the court, and the protection that should be accorded to such experts from complaints of disgruntled participants in legal proceedings. Collins J stressed the serious deterrent effect on paediatrics if experts were left vulnerable to vexatious complaints from clients. Similar to the underlying public policy principle of protecting the administration of justice, Collins J held immunity from sanction should be extended to professional disciplinary proceedings. He cautioned against subjecting the forensic evidence of an expert witness to challenge in other forums, because it will deter expert witnesses. While the immunity recommended is not absolute, the High Court judgment assured experts that evidence given honestly and in good faith would be immune from regulatory or other penalty. The usefulness of the terms honesty and in good faith have limitations. Inattention to methodological rigour by the expert may be excused on the basis of these factors. Experts should be expected to meet high standards, including rigorous critical analysis of their opinions, which ought to be a central element of

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[534] Ibid n 523, Collins.

[535] See *Jones v Kaney* [2011] UKSC 13, a case changing traditional rules on expert immunity. The majority concluded that no justification was shown to continue to allow expert witnesses immunity from suit for breach of duty. However, experts are still likely to be disciplined by professional bodies. Note that this might affect doctors and lawyers, but there are no equivalent disciplinary bodies for forensic scientists.

expertise and their classification as an expert. The legal evidentiary latitude accorded to expert evidence, in contrast to other witness testimony, places an obligation on the expert to provide substantiated, reliable and impartial evidence and to concede limitations and disagreement in their area of expertise. The High Court judgment, therefore, does not address how inadvertent, but nonetheless wrong or misleading, evidence repeatedly provided by an expert is to be dealt with, especially in the high-stakes context of criminal cases.

8.1.1.2 Southall

In 2004, another series of events related to the *Clark* case transpired, illustrating the absolute conviction some child protection paediatricians have in their beliefs. Professor David Southall was investigated by the FPP of the GMC after Steven Clark filed a complaint about his conduct.[536] Southall was not involved in the Clark case, but had watched a TV documentary on the case after Sally Clark's conviction. He became concerned that Clark's husband, Steven Clark, had been responsible for the infants' deaths, rather than Sally Clark. Southall reported these concerns to the police and the Family Court instigated a child protection investigation of the Clark's third son who was in the sole care of Steven Clark, as Sally was incarcerated.[537] Southall had extensive clinical experience in child protection and believed he could detect deliberate suffocation in infants.[538] Southall thought there was a temporal relationship between bleeding from Christopher's oropharynx and attempted suffocation. He believed if it could be proven that Christopher suffered a nosebleed when in Steven Clark's sole care, the injury might

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[536] Ibid n 523, Southall.
[537] 'Father slams expert's allegations' *BBC news* (online) 8 June 2004 <http://news.bbc.co.uk/1/hi/health/3786693.stm>.
[538] Ibid n 144.

be due to attempted suffocation, potentially leading to Sally Clark's conviction being quashed. The police and the Family Court investigated this hypothesis. The Court-appointed a consultant paediatrician, Professor David Southall, to independently review the medical evidence in the Clark trial to assist the Family Court to determine whether the remaining Clark son was at risk in his father's care.[539] Stephen Clark complained to the FPP of the GMC about Southall's report of his suspicions to the police.[540] Southall was found guilty of serious professional misconduct and was disallowed from working in child protection for three years.[541] In 2007, the FPP determined that the period of conditional registration should be extended for a period of twelve months. In September 2008, all conditions of Southall's registration were revoked.[542]

8.1.1.3 Williams

Dr Alan Williams was another specialist whose actions formed the basis of the second appeal in *Clark*. He conducted the post-mortem investigations on both Christopher and Harry Clark and had isolated a strain of bacteria, *Staphylococcus aureus,* in both children. Williams failed to disclose these findings because he believed they were due to contamination and irrelevant to his opinions on the mechanical and medical cause of death. Along with Meadow's statistical evidence about the likelihood of recurrent SUDI from natural causes, Williams' failure to disclose microbiological findings constituted the two grounds upon which Clark made her second and successful appeal. Evidence from two pathologists, not called in the original trial, differed from Williams' opinion,

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[539] Ibid n 8, Clark.
[540] Ibid n 537.
[541] Hall, D.M.B, 'The future of child protection' (2006) 99 *Journal of the Royal Society of Medicine* 6–9.
[542] General Medical Council, Fitness to Practice Panel 'Fitness to Practice Panel 11–16 August and 20–21 September 2008' (accessed 4 June 2011). Registration number 1491739. http://www.gmc-uk.org/concerns/hearings_and_decisions/ftp/20080921_ftp_panel_ southall.asp.

concluding Harry's death was due to staphylococcal infection. This provided the basis for a reasonable alternative mechanism of death. The Court concluded the jury's verdict regarding Harry might have been different had this evidence been before the jury. The verdict on Harry was viewed as unsafe and quashed. Consequently, it followed that a safe conclusion could not be reached about Christopher, and Clark's convictions were set aside after she had spent three years in jail. The Crown did not pursue a re-trial, a decision endorsed by the Court.

Medical experts strongly criticised Williams' failure to fully disclose the microbiological findings, referring to it as a significant error in judgment, with some going so far as to describe it a substandard medical practice. Williams was also found guilty of serious professional misconduct before the FPP of the GMC. The Court strongly criticised the quality of Williams' post-mortem investigation of the Clark infants and his standards of practice, including record-keeping and forensic report writing. Williams was banned from working in the Home Office as a pathologist for three years.[543]

The professional disciplinary outcomes for Meadow, Southall and Williams were remarkable events in the experts' careers, particularly Meadow, who had been held in the highest esteem. The inquiries revealed a collective failure by the physicians to critically analyse their opinions, adopting instead an overly confident stance based on conviction rather than reliable evidence. In Williams' case, he failed to act in accordance with basic professional expectations of disclosing critical information. This likely affected the jury's verdict. Arguably, the Clarks' relative standing in the community, access to resources and ability to counter authority in a meaningful way, led to Sally

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[543] Ibid n 8, *Clark*.

Clark's successful appeal. The responses from the High Court regarding Meadow and the medical community suggest there is discomfort with expectations of transparency and high standards of professional practice. The medical community's willingness to subject itself to critical analysis by courts and professional regulatory bodies, except in circumstances of gross misconduct, such as Williams', is therefore questionable. Ultimately, evidence provided in court should be subject to the same high standards expected of physicians in clinical and research settings. It seems somewhat provocative for medical experts to assert they will not participate in forensic matters if their evidence is open to criticism outside the court. This stance implies medical experts should be immune from regulatory or other criticism and courts should protect their testimony. As the typical medical evidence in SUDI trials is opinion evidence, it is particularly important that the expert's testimony is not only based on subjective belief or conviction lacking substantial evidentiary basis.

There are systemic issues in the management of medical opinion evidence beyond the individual physicians. There is a limited forensic pathology system in the United Kingdom.[544] A number of forensic pathologists operate outside the National Health Service and are regulated by the GMC and the Home Office. There is little else in terms of an institutional framework to support the development of good medical practice.

The judicial inquiries into infant death examined in the following section focussed more broadly on medical investigation of death. These investigations suggest the problems with medical opinion evidence are a pervasive and systemic issue, beyond specific experts.

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[544] Cordner, S, personal communication, 2013.

8.2 Legal responses to *Clark*

8.2.1 The Goldsmith report

After the successful appeals in *Clark* and *Cannings*[545], Lord Goldsmith, Her Majesty's Attorney General, reviewed all cases in which a parent or caregiver had been convicted of homicide of a child under the age of 2 years in the previous 10 years. The review identified 297 cases and the Attorney General considered that in 28 cases (9%) there was cause for concern.[546] These cases were referred to the Criminal Cases Review Commission, the Court of Appeal and defence solicitors. Three of the 28 cases involved sudden infant death and the remaining had detectable injuries. Goldsmith was particularly concerned that an error rate of 9% was unacceptable.

In an addendum to the original report in 2006, Lord Goldsmith conveyed the findings on an additional 89 cases, which he had ordered to be investigated separately as they related to triad deaths.[547] The issue of the safety of these cases arose from divergent medical opinion on the mechanism of death in these cases since the original trials. Lord Goldsmith waited to review these cases until the Court of Appeal made its findings in cases of triad deaths before it, that is *Harris, Rock, Faulder & Cherry*.[548] Of the 89 triad cases, that of *Faulder* was excluded because the injuries did not result in a fatality. The remaining 88 were examined to determine whether there was other evidence of homicide beyond the triad of injuries or whether medical research subsequent to the trial supported the explanation for the injuries provided by the defendant. Of the 88, 10 cases were examined more closely, from which three cases raised concerns about the

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[545] Ibid n 8, *Clarke*; *Cannings*.
[546] Ibid n 351.
[547] The Rt Hon The Lord Goldsmith QC, Her Majesty's Attorney General, *Addendum to Report, Shaken Baby Syndrome* (Crown Copyright, February 14 2006).
[548] Ibid n 8, *Harris*.

safety of the convictions. All case information was examined, with particular emphasis on medical evidence. Two cases related to manslaughter (*Harris* and *Cherry*) and further medical examinations were suggested and the third case did not relate to medical considerations but did raise concern that the necessary intent was not established. Lord Goldsmith advised the respective defence lawyers that the convictions may be unsafe and to consider referral to the Court of Appeal or Criminal Cases Review Commission.

8.2.2 The Kennedy report (2004)

After Sally Clark's successful appeal in January 2003, an expert committee was formed to evaluate and recommend future approaches to medical and other investigation of SUDI. A Working Group was formed between The Royal College of Pathologists and The Royal College of Paediatrics and Child Health, chaired by Baroness Helena Kennedy.[549] The resultant Kennedy report recommended a new national, standardised protocol for death investigation and a multi-professional meeting to examine each death. The report is unclear about how such a protocol would be enforced but emphasised the need for forensically trained paediatric pathologists to conduct autopsies in SUDI cases and noted the current paucity of such specialists in the UK. At the time of the report, there was only one paediatric forensic pathologist and 40 paediatric pathologists working in England and Wales.

The Working Group recommended that paediatricians involved in the acute management of patients should not be expected to give expert testimony in cases involving those patients. The Group was also concerned clinicians may not understand the impartial, detached stance expected of them in forensic settings,[550] and emphasised

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[549] Ibid n 13, Kennedy.
[550] Ibid n 13, Kennedy, 5.

that medical experts must avoid presenting speculation and suspicion as fact. Instead, the Group recommended that medical experts should provide sound reasoning to support forensic assertions:

> *A doctor can be convinced, based on his or her experience, that a defendant is guilty—but unless there is compelling evidence supported scientifically, he or she should not express that view in criminal proceedings.*[551]

The Group expressed concern about experts' understanding of their role in a trial:

> *...doctors are occasionally drawn into error because they base their testimony on medical belief rather than scientific evidence. There is also the temptation, particularly in the very adversarial arena of the criminal courts, to be pushed into certainties where there are none.*[552]

The Kennedy report essentially recommends the type of evidence proffered by medical experts in criminal trials should be evidence-based. Presumably the Working Group recommended evidence-based medical opinion as a means of ensuring expert testimony is reliable or can be evaluated for reliability.

8.3 Canada

8.3.1 Charles Smith

In Canada, the parallel to the English regulatory and judicial events was the judicial inquiry by Goudge J into the conduct of Charles Smith, a respected paediatric pathologist, whose opinions were associated with wrongful convictions and miscarriages of justice. Between 1981 and 2001, Smith, who was based in Toronto, was widely recognised as an expert in paediatric pathology and often appeared for the prosecution

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[551] Ibid n 13, Kennedy, 4.
[552] Ibid n 13, Kennedy, 4.

in criminal trials across Canada.[553] In 1981, Smith started working as a paediatric pathologist in the Hospital for Sick Children (HSC) Toronto. He was responsible for conducting autopsies on deceased children and writing reports, despite lacking formal training in forensic pathology. Smith consulted with police and Crown attorneys, as well as local and regional pathologists, and testified in court. In 1992, Smith was appointed Director of the Ontario Paediatric Forensic Pathology Unit, which was jointly established between the HSC and the Office of the Chief Coroner of Ontario (OCCO). Smith developed a reputation as an expert in paediatric forensic cases, publishing articles and giving lectures on child abuse.

Smith had limited contact with the OCCO Chief Forensic Pathologist, Dr Chaisson, who did not have a role in supervising Smith's work. Drs Young and Cairns, the Chief Coroner and Deputy Chief Coroner of Ontario, respectively, were also not trained as pathologists and unable to oversee his work or judge the accuracy and reliability of his opinions. Testimony in the Inquiry revealed Cairns' confidence in Smith's skills enabled him to support Smith, despite increasing criticism about his work. Similarly, Young did not review court rulings and media articles questioning Smith's expertise, as he was concerned that the OCCO would be unable to fill his position, due to a shortage of pathologists willing to perform Smith's role.

In the course of his duties, Smith gave expert opinion evidence in criminal and child protection proceedings. The types of cases on which he provided opinion included shaken baby syndrome, falls and fatal head injury, asphyxial death, distinguishing between stabbing and dog bites, timing of injuries, newborn infants dying soon after birth and sexual trauma. Some matters ended in convictions, acquittals, or withdrawal

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[553] See generally Ibid n 13, Goudge.

of charges, while others involved negotiated pleas of guilt for lesser offences with associated lesser sentences.

The cases that ultimately led to the Inquiry were that of *Reynolds* and *Veno/Kporwodu*. In 1997, Louise Reynolds was accused of killing her 7 year old daughter, Sharon. Smith gave evidence that Sharon had died from over 80 stabbing wounds from a pair of scissors. Reynolds spent two years in jail. However, the charge was withdrawn when a second autopsy by another pathologist concluded the injuries occurred from dog bites, not stabbing injuries. The child's body was found in the family's basement in which their pit bull terrier lived. Kingston Police had not advised Smith of the dog's presence at the death scene when he conducted the autopsy. However, despite becoming aware of the dog's presence during his investigation, Smith continued to assert the child had died from stab wounds. Later, Smith conceded his opinions were incorrect and he was unfamiliar with distinguishing features of stabbing injuries. He accepted he had asserted the likelihood of dog bites causing the lesions to be as remote as the likelihood of bear bites as an explanation. Smith admitted his opinions were unqualified and unfounded. Despite teaching other experts about the need for impartiality, Smith acknowledged he had adopted an adversarial role in the case.

In March 1998, Angela Veno and Anthony Kporwodu's 3 month old daughter, Athena, died. Smith concluded Athena had died from multiple traumatic injuries. Smith took eight months to complete the autopsy report. In May 1999, Kporwodu was charged with manslaughter. In July 1999, Smith verbally informed the police and Crown he had found a new injury to Athena's liver. The police did not act on this advice, aware there were concerns about Smith's work, and awaited the report before taking further action. In April 2000, Smith produced a written addendum to his original report, which led to new charges being laid in May 2000 against Veno and Kporwodu. In 2005, the Ontario

Court of Appeal stayed the charges due to unreasonable delay – as Smith had failed to provide the necessary reports – and for violating the couple's constitutional right to a timely trial.

In 2004, Dr Barry McLellan succeeded Smith as Director of Paediatric Forensic Pathology. At McLellan's insistence, Smith finally resigned. In 2005, McLellan ordered a coroner's review of all criminally suspicious cases, from 1981 to 2001, in which Smith had conducted the autopsy or had been consulted. The five forensic pathologists who undertook the review questioned Smith's opinions in 20 of the 45 cases they examined, 12 of which had resulted in convictions.[554] In response to this alarming finding, the Ontario government established the Inquiry to investigate systemic failings that allowed Smith to practice largely unchecked and function below standards of expertise for so long without detection.

8.3.2 The Goudge Inquiry into Paediatric Forensic Pathology in Ontario

The Goudge Inquiry into Paediatric Forensic Pathology (the Inquiry) was an exhaustive investigation of Smith's conduct, as well as evidence from international legal and medical scholars and practitioners. Pathologists at round-table discussions in the Inquiry asserted clinicians, such as child protection paediatricians, should not provide an opinion on the mechanism of death, as their area of expertise is not pathology.[555] Dr Michael Pollanen, Chief Forensic Pathologist in Ontario since 2006, gave evidence that forensic pathology had evolved from a traditional approach in which 'expert opinions were largely based on authoritative experience and anecdotal case reports' to an 'evidence-

[554] Ibid n 13, Goudge, Volume 1 (6-7).
[555] Ibid n 13, Goudge, 3 474.

based approach' that requires 'a critical analysis of peer-reviewed literature and attention to primary reviewable evidence from the post-mortem examination.'[556]

Goudge concluded the proper investigation of SUDI requires forensic pathologists specialising in paediatrics, with a peer review network and administrative structure that oversees the pathologist's work. Without this, circumstances that allowed Charles Smith to practice largely unhindered are likely to recur. Goudge concluded forensic pathologists are better equipped to conduct paediatric autopsies than paediatric pathologists and professionalising forensic pathology should be a priority for Ontario. Goudge recommended legislative changes to develop a forensic pathology system serving coronial death investigation; and education, recruitment and funding to enable paediatric forensic pathology to become a recognised medical specialty and provide a high quality service to Ontario.

In his report, Goudge expressed many concerns regarding the manner in which forensic pathologists interact with the justice system. Among Goudge's criticisms were the following four concerns: the nature of the opinions given by forensic pathologists; the means by which pathologists substantiate their conclusions; the ways in which pathologists deliver their opinions; and the expert witness's general awareness of his or her forensic role. Overall, Goudge made 169 recommendations to improve paediatric forensic pathology and forensic pathology, and to provide evidence to the criminal standard of proof. Goudge concluded tribunals have accepted or admitted complex subjective or clinical experience-based opinions expressed by highly regarded medical experts as facts.[557] Goudge recommended the development of a system that ensures

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[556] Ibid n 13, Goudge, 485.

[557] Campbell, K, and Walker, C, 'Medical Mistakes and Miscarriages of Justice: Perspectives on the Experiences in England and Wales' In *Pediatric Forensic Pathology and the Justice System, Inquiry*

forensic pathology evidence is transparent, the reasoning leading to conclusions is clear, and testimony in court is tailored so that inaccuracies and misconceptions arising from language or testimony is limited.

The Inquiry found many problems with Smith's work, highlighting 10 areas in which he failed as an expert witness to the court: (1) the expert's role is to convey scientific findings, his or her opinion, and the level of certainty of the opinion, rather than being advocates for the party calling the expert;[558] (2) the expert is expected to have a complete understanding of the case and the basis of their opinion, to assist the court;[559](3) it is the expert's responsibility to advise the court of limitations in their expertise and areas that inform their opinion but about which they lack knowledge or experience, so the court is able to properly assess whether their opinion should be admitted; [560] (4) although the basis for admitting expert evidence is the expert's experience in a particular area, their opinions should not only include personal anecdotal evidence;[561] (5) the expert is expected to apprise the court of controversies within the discipline, as well as their interpretation of scientific findings and the literature, so a proper assessment can be made of the opinion.[562] Goudge suggested this approach would ensure the expert's opinion is not unbalanced. Criticism of colleagues' work must be accompanied by a reason, as disparaging, unjustified or arrogant remarks were 'unprofessional and entirely unhelpful to the court';[563] (6) expert witnesses are only allowed to give opinion evidence in their area of expertise, not other areas about which

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into Pediatric Forensic Pathology in Ontario, Independent Research Studies (Ministry of the Attorney General, Toronto, 2008) 2 325.
[558] Ibid n 13, Goudge, 180.
[559] Ibid n 13, Goudge, 180.
[560] Ibid n 13, Goudge, 182.
[561] Ibid n 13, Goudge, 182 – 183.
[562] Ibid n 13, Goudge, 184.
[563] Ibid n 13, Goudge, 185 -186.

they might have an opinion; (7) experts are expected to remain within the realms of their expertise, advise the court if any testimony is outside their expertise, and judges and counsel are expected to ensure the boundaries of expertise are respected;[564] (8) experts must ensure their opinion is not speculative and is substantiated by necessary evidence, a role that is the responsibility of the expert but the court and counsel also have a duty to prevent experts from giving inappropriate evidence that is potentially prejudicial and unhelpful;[565] (9) the expert's language in communicating their opinion affects 'how the court will perceive and weigh the opinion'.[566] Goudge found Smith's opinions and his certainty in the opinions was expressed casually by using betting terminology that was unscientific and inappropriately inexact, and that masked the fact that the testimony was speculative;[567] and (10) the expert's opinion should be expressed with honesty and candour with no false and misleading statements.[568] Goudge concluded these are common pitfalls not specific to Smith and participants in criminal proceedings need to be aware of potential issues to avoid further miscarriages of justice.

Overall, Goudge stressed that medical opinion evidence must describe the results of pathological investigation, the reasoning underlying conclusions and limit interpretations to forensic pathology. He suggested 'basic principles' for improving forensic pathology so that it seeks actual facts about an infant's death, rather than adopting an overly suspicious stance in which confirmation of homicide is the only hypothesis considered by the forensic pathologist. Firstly, Goudge stressed the forensic pathologist must have an independent (of the police, Crown, defence and any other

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[564] Ibid n 13, Goudge, 419.
[565] Ibid n 13, Goudge, 187 - 188.
[566] Ibid n 13, Goudge, 188.
[567] Ibid n 13, Goudge, 188.
[568] Ibid n 13, Goudge, 189.

parties involved), evidence-based approach 'based on objectivity, accurate reporting of observations, following the autopsy where it takes you even if it is an undetermined outcome'.[569] Goudge considered this approach would guard against confirmatory biases in which the pathologist evaluates evidence in line with their own preconceived theory. However, objectivity, impartiality and independence are different constructs, which may not be clearly related to each other and achieve the reliability necessary for medical opinion evidence in criminal trials. Overcoming confirmatory bias is also an effortful task that is not easy to achieve. Goudge nonetheless cautions against letting personal beliefs and speculative opinions influence their testimony.

The second principle is transparency that enables a review of the forensic pathologists work. This includes recording and retention of pre-autopsy and autopsy findings. The third principle requires the forensic pathologists work to be understood by both the criminal justice system and laypeople. As consultation improves performance, Goudge's fourth principle requires the forensic pathologist to have a teamwork approach with the coroner and other medical specialists. Lastly, the forensic pathologist 'must be driven by a commitment to quality'.[570]

A particular concern about the way in which paediatric death investigation was conducted in Ontario arose out of a directive to adopt a suspicious stance in death investigation:

> *Unfortunately, in this day and age, child abuse is a real issue, and it is extremely important that all members of the investigative team "Think Dirty". They must actively investigate each case as potential child abuse, and not come to a premature conclusion regarding the cause and manner*

[569] Ibid n 13, Goudge, 3, 374.
[570] Ibid n 13, Goudge, 3, 374.

of death until the complete investigation is finished and all members of the team are satisfied with the conclusion.[571]

This memo was distributed as a directive: 'You Shall Use It'.[572] In his evidence to the Inquiry, McLellan explained the aim of the memo was to ensure paediatric death cases were thoroughly investigated, including conducting autopsies, skeletal surveys, and toxicology, which were not being routinely conducted.[573] Some pathologists testifying at the Inquiry interpreted this directive as a need for a higher index of suspicion, rather than all unexplained deaths constitute homicide.[574] However, evidence from Chiasson indicated such a directive made pathologists vulnerable to pressure from the police to return findings consistent with their pre-existing theory of the mechanism of death.[575] Goudge was critical of any approach based on thinking 'dirty' which could, as he found had in Smith's case, led to errors or fostered an overly suspicious stance in death investigation. Goudge endorsed the October 2007 Autopsy Guidelines in which the OCCO revoked the instruction to 'think dirty' in favour of being open-minded and objective in death investigation, citing the guidelines:

The emphasis on the independent, objective and evidence-based approach in forensic medicine can be viewed as revision of an old forensic aphorism from "Think Dirty" to "Don't Think Dirty; Think Objectively, Think Truth."[576]

As forensic pathology is interpretive, an objective approach based on evidence is the preferred position, collecting evidence to both support and refute hypotheses. More

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[571] Ibid n 13, Goudge, PFP091216, 2, referring to 'Memo 631' sent out on 10 April 1995.
[572] Ibid n 13, Goudge, Evidence of Dr. Cairns, November 27, 2007, 220.
[573] Ibid n 13, Goudge, Evidence of Dr. McClellan, November 12, 2007, 205, lines 10-15.
[574] Ibid n 13, Goudge, Evidence of Dr Glenn Taylor, December 18, 2007, 144, lines 7 – 12.
[575] Ibid n 13, Goudge, Evidence of Dr. Chiasson, 12/10/07, 254, lines 1-7.
[576] Ibid n 13, Goudge, 3, 376.

importantly, the expert charged with the task of determining the mechanism of death must be able to consider all available medical evidence without pressure to conform to the theories of police or other parties to the investigation.

Goudge was concerned about Smith's reliance on non-medical and indirect or circumstantial evidence unrelated to medical facts when deciding the mechanism of death. He recommended pathologists must remain within their expertise when forming opinions to avoid, under the guise of scientific opinion, presenting a conclusion drawn from the circumstantial evidence.[577] Goudge's use of the term circumstantial evidence, as opposed to the case history, seems to be referring to non-pathological evidence. The extent to which the use of non-pathology evidence can be considered in forming an opinion may be affected by the potential unreliability or contentious nature of the circumstantial evidence and by how close it comes to the ultimate issue that the court must decide. Goudge stressed forensic pathologists should not use circumstantial evidence or non-pathology information to bear the entire burden of support for an opinion. However, he accepted a forensic pathologist might have to consider hypothetical questions regarding circumstantial evidence to determine the extent to which a reported history is supported or contradicted by the pathological findings. An example of relevant non-medical evidence is the presence of a pit bull terrier at the scene of death, as in the death of Louise Reynolds' daughter. Goudge stressed transparency was required, particularly regarding the extent to which circumstantial evidence was relied on and influenced opinion on the mechanism of death. One of the problems in

[577] Ibid n 8, Matthey, 136. Similarly, Cordner discouraged forensic pathologists from making deductions from circumstantial evidence, such as the presence of the accused mother at the deceased infant's bedside.

Smith's work was that he did not disclose circumstantial information, which affected his opinions.

Goudge cautioned forensic pathologists to avoid 'default diagnoses'.[578] He noted that the accused's inability to credibly explain the mechanism of death ought not to be substituted for the necessary or sufficient pathology findings to support a determination of homicide. In particular, a formulation such as 'in the absence of a credible explanation, the post-mortem findings are regarded as resulting from non-accidental injury' should not be used. If the medical evidence is insufficient to identify the mechanism of death, the death should be characterised as 'undetermined'.

In triad cases, Goudge identified three areas in which the predominant medical view has shifted over the years:

i) That the triad alone is diagnostic of SBS no longer holds;

ii) That short falls can never cause fatal injury no longer holds; and

iii) Most pathologists agree that this area of their specialty has become significantly more controversial than it was in the early or mid-1990s.[579]

Goudge described current forensic pathologists as being on a spectrum of opinion about what can and cannot be said about the triad and its association with shaking mechanisms of injury. Goudge's observation is similar to that of the Court *Harris*, in which the judges concluded the triad is a 'strong pointer' to non-accidental or inflicted head injury but cautioned the presence of the triad does not automatically indicate the injuries were caused by shaking or non-accidental means.[580] Goudge believed the conclusion in *Harris* raised questions about whether or when the triad alone meets the beyond

[578] Ibid n 13, Goudge, 3, 415.
[579] Ibid n 13, Goudge, 3, 528.
[580] Ibid n 8, *Harris*, 70.

reasonable doubt standard of proof,[581] which was also an issue examined in the Goldsmith inquiry into shaking deaths.[582]

Despite limitations in the current knowledge base underlying forensic pathological investigation of SUDI, Goudge concluded subjective opinion evidence or clinical experience-based evidence can be assessed for reliability, admitted appropriately, and assigned justifiable weight by legal counsel if the expert properly informed the court of its limitations.[583] The problem for tribunals and courts is how best to assess the reliability and accuracy of expert evidence and determine whether it *should* be admitted to trial. Goudge's recommendations do not specifically address how courts can assess the reliability and accuracy of medical opinion evidence. Rather, his conclusions involve ensuring medical opinion evidence is substantiated by a transparent investigation and reasoning process and peer review or professional oversight to improve the quality of medical opinion evidence. Deciding whether medical opinion evidence is reliable seems to be based on peer review and oversight, rather than a critical analysis of whether the content of medical opinion evidence is reliable and accurate. The recommended process, which should make the conduct of infant death investigation more transparent, does not provide the court or jury with a methodology for assessing the reliability of medical opinion evidence in SUDI where independent validation of the mechanism of death is rare and the reliability of investigative and reasoning processes and conclusions about death investigation is unclear. In this sense, Goudge's recommendations are the beginning of a much-needed process but whether this leads to wider changes to infant death investigation remains to be seen. More importantly, the

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[581] Ibid n 13, Goudge, 3, 527.
[582] Ibid n 547.
[583] Ibid n 13, Goudge, 2, 75.

medical community ought to be closely involved in providing information about current areas of agreement and disagreement and the reliability of the methodology and derivative opinions that come before courts.

8.3.3 Smith disciplinary hearing

In March 2007, Smith was the subject of a civil law suit brought by Louise Reynolds.[584] In a groundbreaking decision, the Court of Appeal ruled that the suit against Smith and other experts could proceed, on the basis that, while court testimony is protected, faulty work was not. In February 2011, The College of Physicians and Surgeons of Ontario found Smith incompetent and revoked his registration on the grounds of professional misconduct.[585]

8.4 Conclusions

The appeals and inquiries succeeding *Clark*'s successful appeal and the Inquiry into Smith's conduct revealed a multitude of problems in the investigation and prosecution of SUDI thought to constitute homicide. The problems ranged from limitations of current medical knowledge about why some infants die suddenly to overconfidence on the part of medical experts to a common law legal system that does not require judges to assess expert evidence for reliability. The reliance on non-medical facts, such as evidence of a psychosocial nature, has clouded the fact that in many cases there is no medical reason for the medical expert to conclude that death constitutes homicide. Lack of standard procedures and investigative rigour on the part of paediatric pathologists and paediatricians specialising in child protection has affected the reliability of medical

[584] Ibid n 527.
[585] Ibid n 528.

opinion evidence in SUDI cases. The reviews strongly recommended a standardised, evidence-based approach was essential if medical experts were to reach the level of transparency and reliability required to assist courts in their fact-finding task.

The inquiries found paediatric pathologists and child protection paediatricians were particularly prone to assume a suspicious stance in which it was not clear that alternative hypotheses to homicide were considered to a substantial extent, or if they were, the expert's evidence did not reveal how or why other hypotheses were rejected. Child protection paediatricians and paediatric pathologists were often closely involved with the police and prosecution, which is likely to have affected their ability to form views independent of theories developed by other investigators. Medical experts were insufficiently critical of their own investigation and subsequent reasoning, effectively altering the presumption of innocence so that accused parents were required to prove they had *not* committed a crime.

The Goudge Inquiry was a more exhaustive examination of paediatric pathology and SUDI than the English and Welsh inquiries, with extensive recommendations for the practice of child death investigation. Among his many recommendations, Goudge emphasised the role of non-medical or circumstantial evidence in introducing bias and error into medical decision-making about the mechanism of death. The pathologist's knowledge of other facts not directly relevant to the medical investigation of death or about which there are specious assumptions regarding their inculpatory meaning is a pervasive challenge in all death investigations. There are many aspects of the deceased infant's life about which the medical expert will be aware. The earlier discussion of psychological processes that affect expert judgment showed that contextual variables such as these could interfere with evidence-based, rational decision-making. This is a concern as the reliability and accuracy of such

evidence in assisting death investigation is unknown but the potential to lead to bias or incorrect judgments in significant. It is difficult to control the influence of non-medical case facts on medical opinion evidence. However, a practice of recording and reporting *all* known information about the case, identifying facts that have informed judgments and those that have not, and explaining the reasoning that led to the mechanism of death identified, would assist the court in assessing the extent to which the opinion is justified on the facts disclosed. Such an approach is also likely to force the expert to deliberately examine their decision-making process, which could increase the likelihood the expert resists speculation, limits his or her judgments to medical facts and avoids unjustified or unsubstantiated assertions of opinion, as all aspects of their investigation and decision-making have to be disclosed.

The medical community has also raised concerns about the expert's role and the need to arrive at their professional opinion, independent of the adversarial process or the side that has called them. The integrity of their opinion must be preserved, irrespective of any pressure or influence from those involved in the trial.[586] Medical opinion evidence is interpretive and differences between experts will occur and should not be seen as a sign of inaccuracy or poor opinion. Courts and medical experts may have to accept, in some cases, medical evidence will fail to identify the mechanism of death.

Overall, Goudge recommended greater oversight and training of medical specialists involved in death investigations, as well as stronger admissibility standards for expert evidence with the trial judge actively evaluating and deciding whether to admit

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[586] Editorial, 'Suspected child abuse: the potential for justice to miscarry' (2003) 327 *British Medical Journal* 299-300.

evidence. It is clear that improvements must start with the relevant medical specialists involved and, while the trial judge must decide on the reliability of medical opinion evidence, the adversary system, as it stands today, cannot be relied on to detect unreliable expert evidence during a trial. Goudge also recommended the establishment of a forensic pathology service independent of the coroner, police and others involved in criminal investigation and prosecution. In particular, Goudge saw the need to provide forensic pathology from an institutional setting in order to provide a framework for developing the best possible practice. This is a point that has yet to be recognised by the United Kingdom.

The judicial and medical regulatory body investigations have not, however, addressed, in any significant way, the issue of reliability and the need for the medical community to inform courts about the state of knowledge in the relevant area dealing with the death in question. This is the responsibility of the medical community and the many experts who provided evidence for the Goudge Inquiry have begun a process that needs to be applied in practice, from death investigation to providing testimony at a criminal trial. This is a critical step needed to prevent future wrongful convictions.

The events in the UK and Canada demonstrate how the problem of unreliable medical opinion evidence or medical opinion evidence of unknown reliability has affected the ability of courts to render fair verdicts. The problem is pervasive and has wider implications than the specific medical experts who have been the subject of medical regulatory, appellate court, and judicial inquiries. The risk of errors in judgment in SUDI investigation cannot be overestimated, given the difficulty in independently corroborating the mechanism of death, as well as the host of uncertainties in correctly interpreting medical findings from death investigations. The consistent message from these inquiries is the importance of transparency and full disclosure of outcomes of

investigations, data collected, missing information, and non-medical facts relating to the case; justification of opinions in ways understandable by non-medical individuals and courts; and a willingness to acknowledge when a research or literature base does not convincingly provide an explanation for a particular death. The importance of the expert being an impartial advisor to the court, instead of an advocate for the prosecution, is a prominent message from the inquiries, and the appellate cases.

SECTION III

Chapter 9: Law of evidence

Frequently, the accurate and fair legal determination of whether an infant death or deaths constitute homicide depends on the quality of expert evidence grounding the decision to prosecute and admitted to prove guilt (or raise doubt) at trial. In theory, the admissibility and quality of this evidence is governed by rules of evidence. A critical question is whether admitted expert evidence is representative and reliable and, regardless of reliability, whether those determining admissibility and guilt are able to appreciate limitations and understand the evidence.[587] The following analysis of the law of evidence, as it applies to medical expert evidence, provides a brief overview of rules that govern admission of such evidence and reveals that existing standards often fail to ensure that medical opinion evidence admitted to trial is reliable and not unfairly prejudicial. Those failures raise the risk that insufficiently reliable medical opinions are thereby contributing to miscarriages of justice and wrongful convictions. The preceding review of medical research on smothering and triad deaths indicates that the medical evidence used to prove homicide is often inconclusive and unable, alone, to satisfy the criminal standard of proof.[588] In principle, the law of evidence should protect against the admission of unreliable and unfairly prejudicial evidence. Wrongful conviction or apparent miscarriages of justice raise significant questions about the effectiveness of legal regulation of expert evidence and proof in serious criminal proceedings. The

[587] Allen, R.J, 'The Common Law Theory of Experts: Deference or Education?' (1992) 87 *Northwestern University Law Review* 1131- 1147.
[588] Associated psychosocial evidence, by itself or with other evidence, might provide support for homicide if there are behavioural manifestations, such as previous abuse of the deceased.

following discussion is based on Australian law. While there are differences in the law of evidence across the three common law jurisdictions examined in the thesis, England and Wales, Canada, and Australia, all rely heavily on their shared common law heritage. Until recently there was little overt interest in reliability and to a considerable degree each continues to admit similar types of expert medical opinion in relation to child death and other prosecutions.[589]

9.1 Law of evidence

Rules regulate the types of evidence that might be admitted in criminal proceedings. These rules provide a legal structure that enables lawyers and judges to determine how and what evidence can be adduced, whether such evidence will be admissible and for what purpose(s), and how the fact-finder – judge or jury – is to decide the factual issues based on the evidence. In Australia, the laws of evidence arose out of common law drawn from England and developed by the courts; with occasional statutory modification. When the *Evidence Act 1995 (Cth)*,[590] the *Evidence Act 1995 (NSW)*,[591] the *Evidence Act 2001 (Tas)*,[592] the *Evidence Act 2008 (Vic)*[593] and the *Evidence Act 2011 (ACT)*[594] were enacted, they replaced much of the common law and replaced or incorporated various statutory supplementations. The admission of evidence to a criminal trial in most Australian jurisdictions, though excepting Western Australia, South Australia,

[589] Canada has embraced reliability as a supplement and England and Wales is set to, but the differences are yet to become apparent.
[590] Evidence Act 1995 Commonwealth.
[591] Evidence Act 1995 New South Wales.
[592] Evidence Act 2001 Tasmania.
[593] Evidence Act 2008 Victoria.
[594] Evidence Act 2011 ACT.

Queensland and the Northern Territory, is governed by uniform evidence law based on the *Evidence Act 1995* (hereafter 'the Act').[595]

The purpose of the criminal trial is to convict those who have committed criminal offences. Typically, the state brings a prosecution when there is suspicion that a criminal offence has been committed and if the prosecutor is satisfied that there is a real chance of achieving a conviction on the admissible evidence. The decision to prosecute a person who is alleged to have committed a criminal act results in the adversarial criminal trial when that person maintains their innocence.[596] The aim of the criminal trial is to produce an accurate outcome, otherwise expressed as achieving factual rectitude.[597] A fundamental element of the accusatorial criminal trial is that it is embedded in 'rational tradition' in which determination of 'truth' or factual rectitude is paramount,[598] otherwise expressed as accuracy of outcome.[599] Alongside efforts to achieve a correct result, the trial has to achieve a balance between constraints imposed by the need for finality and fairness.[600]

As the adversarial trial aims to deliver a fair process,[601] there are a range of protective rules and procedures to ensure that rectitude is not pursued at any price, as the social cost of accuracy can be onerous. Fairness is viewed within an entangled

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[595] In practice, and especially in relation to expert opinion evidence, there are many similarities in the way all Australian jurisdictions assess and regulate evidence and proof.
[596] There are often very real pressures or incentives to accept a lower charge as part of a plea negotiation.
[597] See Ashworth, A.J, and Redmayne, M, *The Criminal Process* (Oxford, Oxford University Press, 2005), Chapter 2; and generally, Duff, A, Farmer, L, Marshall, S, and Tadros, V, (Eds). *The Trial on Trial: Towards a Normative Theory of the Criminal Trial.* (Hart Publishing, Oregon, 2007) Volume 3.
[598] See Duff, A, Farmer, L, Marshall, S, and Tadros, V, (Eds). *The Trial on Trial: Truth & Due Process*. (Hart Publishing, Oregon, 2004) Volume 1; Ibid n 58, Twining.
[599] McEwan, J, 'Ritual, Fairness, and Truth: The Adversarial and Inquisitorial Models of Criminal Trial' In Ibid n 598, Duff et al.
[600] Jackson, J.D, 'Managing uncertainty and Finality: The Function of the Criminal Trial in Legal Inquiry' In Ibid n 598, Duff et al.
[601] See generally Ibid n 598, Duff et al.

framework of human rights, social democratic values and legal traditions. Emphasis is placed on avoiding the error of convicting an innocent person.[602] In practice, the trial attempts to reach the correct decision and convict only those who are proven to be guilty. There is therefore a tendency to err on the side of allowing the guilty to go free, rather than convicting and punishing those who are, or might be, innocent.

Primacy of human liberty, a centuries old notion, underlies the presumption of innocence in a criminal case. Consequently, in a criminal trial, it is usually the state's responsibility – through the Crown or prosecutor – to prove the guilt of an accused person to the criminal standard of proof—namely 'beyond reasonable doubt'. There is an asymmetry in the criminal justice process in that the burden of proof falls on the state (or Crown). The prosecution is required to prove *all* elements of the offence to this standard of proof, as well as refuting any evidence raised by the defence.[603] Compared to a civil hearing in which the purpose is to resolve a dispute, the purpose of the criminal trial is to determine what actually happened in a way that is fair to the parties and respects the premium placed on innocence/liberty. The high standard of proof and burden are imposed on the state, as these expectations reflect the presumption of innocence and ostensibly assist in avoiding wrongful convictions.[604]

9.1.1 Relevance

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[602] See Ibid n 58, Twining; Ibid n 598; Ibid n 597, Duff et al; Jackson, J.D, and Summers, S.J, *The internationalisation of criminal evidence: Beyond the Common Law and Civil Law Traditions.* (Cambridge University Press, 2012) on this subject.
[603] The defence is not required to provide evidence to this standard. Apart from some defences where the defence has an evidentiary obligation, the defence can generally elect to do nothing and require the state to prove guilt beyond reasonable doubt – generally a risky strategy – or to attempt to raise doubts.
[604] See Laudan, L, *Truth, error, and criminal law: an essay in legal epistemology* (Cambridge, Cambridge University Press, 2006).

Sections 55-56 of the Evidence Act detail the first criterion for admission of evidence, namely relevance.

Section 56 states:

(1) Except as otherwise provided by this Act, evidence that is relevant in a proceeding is admissible in the proceeding.

(2) Evidence that is not relevant in the proceeding is not admissible.

Subject to exclusionary rules in the Act, evidence that is relevant is admissible.

Section 55 states:

(1) The evidence that is relevant in a proceeding is evidence that, if it were accepted, could rationally affect (directly or indirectly) the assessment of the probability of the existence of a fact in issue in the proceeding.

(2) In particular, evidence is not taken to be irrelevant only because it relates only to:

(a) the credibility of a witness, or

(b) the admissibility of other evidence.

Evidence is relevant if it has probative value. That is, evidence is relevant if it has a rational ability to influence facts in issue.

The threshold for relevance is low. Where there is doubt about relevance, including circumstances where we are not sure about the value of an expert's methods or opinion, judges usually admit the evidence rather than exclude it because it is conventionally seen as the responsibility of the fact-finder to assign 'weight' and determine its relationship to the facts in issue – if the evidence is accepted.

9.1.2 Admissibility

Expert evidence is a fundamental element in infant homicide trials that is regulated by particular rules of evidence. Most expert evidence, and most disputed expert evidence, is opinion evidence. The law tends to distinguish between fact and opinion evidence. Accepting that the boundary is often complicated or murky, with a few explicit exceptions, opinion evidence is ordinarily inadmissible. Section 76(1), the opinion rule, seems to cover the field. It states:

> *(1) Evidence of an opinion is not admissible to prove the existence of a fact about the existence of which the opinion was expressed.*

Although opinion evidence is presumptive inadmissible, there are several enumerated exceptions. One of the most important is the exception for relevant expert opinion evidence, described as opinions based on 'specialised knowledge'. Ordinarily these are opinions intended to support or prove the fact or facts about which the opinion was expressed. An opinion about the mechanical cause of death of a child is, for example, often intended to support an allegation of unnatural death and, implicitly, manslaughter or murder.

The opinion of an expert is generally admissible as a formal exception to the exclusionary opinion rule, resembling the exception provided for expert opinion at common law. Assuming its relevance – the ability to 'rationally affect …the assessment of the probability of the existence of a fact in issue' – the admissibility of opinion evidence by an expert is governed by ss 76 and 79 of the Act.[605] Section 79(1) provides the primary exception to s 76. It provides that:

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[605] Where we do not know if the opinion is reliable, relevance may be an issue, although the law gets around this by deferring to what a lay jury might think about the value of an opinion – i.e. 'if accepted'.

If a person has specialised knowledge based on the person's training, study or experience, the opinion rule does not apply to evidence of an opinion of that person that is wholly or substantially based on that knowledge.

The main criteria for inclusion are: 'specialised knowledge' based on 'training, study or experience' and for the opinion to be 'wholly or substantially based on that knowledge'. Once expert opinion evidence is admitted, the weight assigned to it is left to the fact-finder to determine. Specialised knowledge is not defined in the Act and 'reliability' has not been read into 'specialised knowledge', as it has in the United States. In the United States, the *Frye*[606] test of admissibility of scientific opinion held that a technique is admissible only when there is general acceptance within the scientific community that the technique is reliable. *Frye* was superseded by the Federal Rules of Evidence.[607] *Daubert* required judges to be gatekeepers to ensure that scientific expert testimony is relevant *and* reliable.[608] Criteria for determining reliability are: whether a theory or technique has been tested; subjected to peer review and publication; has a known or potential error rate, and has received 'general acceptance'.[609] However, forensic evidence of uncertain or unknown reliability has been admitted in some jurisdictions after *Daubert*.[610] The possible reasons include, trial judges' inability to conduct reliability assessments, defence lawyers lacking sufficient knowledge about the

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[606] *Frye v United States* 293 F. 1013 (D.C. Cir. 1923).
[607] *Daubert v Merrill Dow Pharmaceuticals* Inc 931 Fd 2nd 1128 (9th Cir 1991). Daubert is a leading American case in which the plaintiffs proffered expert testimony linking Benedictin, an anti-nausea drug used in pregnancy, to birth defects. It was held, however, that the expert evidence was not 'generally accepted' within the scientific community. The US Supreme Court held that when opinions have not gained general acceptance, the knowledge must be arrived at by an appropriate and accepted scientific method.
[608] Ibid n 602**,** Jackson, 49.
[609] In *Kumho* the court explained that reliability applied to other kinds of expert evidence and the indicative criteria might be applied flexibly.
[610] Beecher-Monas, E, *Evaluating Scientific Evidence: An Interdisciplinary Framework for Intellectual Due Process* (Cambridge University Press, 2006) 95-6.

particular area of expertise and prosecutors who are not required to attest to the reliability of evidence they adduce.[611]

In Australia, the meaning of s 79(1) is addressed in the case law. In a case involving body identification expert opinion, *R v Tang*,[612] Tang was convicted on one count of armed robbery, with two accomplices. The Crown relied on expert evidence from Dr Sutisno, a body mapping/identification expert, who used facial and body mapping techniques to identify Tang in video surveillance from the store. Dr Sutisno stated she had extrapolated facial mapping techniques to body mapping. However, she refused to describe her methodology on the grounds that she was patenting her technique. [613] The appeal argued that the identification evidence was inadmissible as expert opinion evidence. In determining whether Dr Sutisno's opinion satisfied the admissibility test for expert opinion evidence, Spigelman CJ held that s 79 has two 'limbs' consisting of the opinion being 'specialised knowledge', derived from training, study or experience; and 'wholly or substantially based on that knowledge'. The admissibility requirement is that the opinion must be demonstrably based on specialised knowledge. It was held that facial identification was a novel area lacking the necessary background and support to successfully establish a foundation for admissibility. Therefore, the expert's evidence was inadmissible. Importantly, the court held that 'specialised knowledge' was the issue, not an extraneous idea such as 'reliability'.[614]

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[611] Risinger, D.M, 'Goodbye to All That, or A Fool's Errand, By One of the Fools: How I Stopped Worrying About Court Responses to Handwriting Identification (and 'Forensic Science' in General) and Learned to Love Misinterpretations of Kumho Tire v. Carmichael' (2007) 43 *Tulsa Law Review.* 447-476 (473); Giannelli, P.C, and McMunigal, K.C, 'Prosecutors, Ethics and Expert Witnesses' (2007) 75 *Fordham Law Review* 1493-1538.
[612] *R v Hien Puoc Tang* [2006] NSWCCA 167.
[613] Ibid n 612, 154.
[614] Ibid n 612, 137 directing attention to *Velevski v The Queen* (2002) 76 ALJR 402 at 82, [154]-[160]; Odgers, S, *Uniform Evidence Law* (6th edition) par [1.3.4260].

The court held that 'knowledge' in s 79 was akin to the majority judgment in *Daubert*.[615]

> *[The] word 'knowledge' connotes more than subjective belief or unsupported speculation. The term applies to any body of known facts or to any body of ideas inferred from such facts or accepted as truths from good grounds.*
>
> The quoted definition is from an American Dictionary.[616]

The court held that Dr Sutisno's evidence constituted subjective belief, thereby failing the 'specialised knowledge' requirement of s 79. The court concluded that neither facial, nor body mapping evidence constituted 'specialised knowledge of a character that can support an opinion of identity'.[617] Furthermore, Sutisno's three opinions were 'bare *ipse dixit*',[618] as she had refused to identify her methodology or the basis of her opinion. The appeal was allowed.

Tang is important because it interpreted 'specialised knowledge' in s 79 – namely, whether the opinion was based on an identifiable body of specialised knowledge and whether the expert based his or her opinion on that specialised knowledge. It has not been read to require an assessment of the reliability of expert opinion. Exempting reliability considerations of expert opinion is troubling, as a body of experts can have faith in a theory or method, without revealing whether either the theory or method, and the derivative opinion are of sufficient accuracy and reliability to be of assistance to the trier-of-fact.

Formal training and experience, rather than attention to reliability and accuracy, govern admissibility decision-making for expert evidence. Medical opinion evidence in

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[615] Ibid n 607,609.
[616] Ibid n 612, 138; See *Daubert* at 596 for reference to dictionary.
[617] Ibid n 612, 146.
[618] Ibid n 612, 154.

SUDI *is* a specialised body of knowledge but, absent evaluation of its reliability or the effect of expert disagreement about SUDI investigation, there is a real risk that the evidence will be irrelevant or misleading or, ultimately, unfairly prejudicial.

9.1.3 Mandatory and discretionary exclusions (ss 135, 137)

The Act governing the admission of evidence also provides for discretionary and mandatory exclusions of otherwise admissible evidence, via ss 135 and 137, respectively. Section 137, which is mandatory and sets the most demanding threshold, states:

> *In a criminal proceeding, the court must refuse to admit evidence adduced by the prosecutor if its probative value is outweighed by the danger of unfair prejudice to the defendant.*[619]

This section aims to prevent the admission of unreliable, prejudicial or otherwise dangerous evidence. Once a judge is persuaded by the accused that the evidence is unfairly prejudicial, the evidence must be excluded if the unfair prejudice substantially outweighs the probative value.[620]

In NSW the leading authority is the judgment of Spigelman CJ in *R v Linard Shamouil*,[621] which endorsed a restrictive view of the operation of s 137, holding that 'issues of credibility' or matters of 'general reliability' should not be taken into account when assessing 'probative value'.[622] Although s 137 is intended to protect against 'unfair prejudice', the term is not defined in the Act. Case law, predating the Act, provides guidance on the definition of 'unfair prejudice'. Section 137 does not relate to highly

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[619] This is similar, though more demanding, than the common law *Christie* discretion.
[620] *R v Lock* (1997) 91 A Crim R 356, 364.
[621] *R v Shamouil* (2006) NSWCCA 112; see also Kumar, M, Odgers, R. and Peden, E, *Uniform Evidence Law* (Lawbook Co, 2009) 3rd edition.
[622] *R v Shamouil* (2006) 66 NSWLR [60-64].

probative inculpatory evidence that is inevitably prejudicial to the accused; rather it is concerned with evidence that is unfair or causing unfairness.[623] 'Unfair prejudice' was explained in an Australian Law Commission Report as the danger that the jury will misuse the evidence, especially by treating it in an irrational way or assigning it greater weight than it can rationally sustain.[624] Unfair prejudice resulting from the misuse of evidence is a particular risk with expert opinion evidence, especially when reliability and probative value of the evidence is unknown.[625] Judicial discretions lacking an evaluation of the reliability of prosecution inculpatory expert opinion evidence cannot achieve the purpose of s 137 – namely, to ensure that unfairly prejudicial evidence is excluded from the jury. Procedural unfairness, such as the inability to cross-examine a witness, can also create the risk of unfair prejudice.

Historically, courts have expressed anxieties about evidence misleading juries or juries being poorly positioned to adequately evaluate it.[626] Criminal trials should be particularly concerned about potentially unreliable evidence, as the jury might misuse such evidence or cause the accused to suffer prejudice in the procedural sense. Such evidence can be excluded, formally moderated, or come with judicial warnings about expert disagreement and/or the dangers of excessive reliance on it. However, once expert opinion evidence is deemed to have satisfied the relatively low standards set by ss 55,

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[623] Australian Law Reform Commission, *Evidence (Interim)*, Report No 26 (1985) [957] ('ALRC'). Other examples include *Papakosmas v The Queen* (1999) 196 CLR 297, [91]–[94] (McHugh J); *R v Clark* [2001] NSWCCA 494, Queen (1999) 196 CLR 297, [91]–[94] (McHugh J) ; R v Clark [2001] NSWCCA 494, [164] (Heydon JA, Bell J concurring and Dowd J concurring in part) [164] (Heydon JA, Bell J concurring and Dowd J concurring in part).

[624] Ibid n 623, 644. This report contributed to the research background to the drafting of the NSW and Commonwealth Evidence Acts. The passage was recently endorsed in ALRC, Uniform Evidence Law, Report No 102 (2005) [16.24].

[625] Edmond, G, 'Specialised Knowledge, the Exclusionary Discretions and Reliability: Reassessing Incriminating Expert Opinion Evidence' (2008) 31 *UNSW Law Journal* 1-55.

[626] Smith, T, and Odgers, S, 'Determining 'Probative Value' for the Purposes of Section 137 in the Uniform Evidence Law' (2010) 34 *Criminal Law Journal* 292-306.

56 and 79(1), few judges use ss 135 and 137 to exclude evidence (when it is challenged).[627] They may use these sections to constrain or influence what an expert states and the strength of any opinion expressed.[628] However, constraints do not seem to be related to underlying concerns about the evidence or jury understanding of expert testimony. Even when judges do constrain the extent of an expert's opinion, this does not address the problem of evidentiary reliability.

9.1.4 Tendency and coincidence

Tendency refers to evidence that because of a propensity or tendency to act or think in a particular way on other occasions, the accused acted or thought in the same way on the occasion in question; that is, the accused has a tendency or propensity to act in a certain manner. Coincidence evidence involves drawing an inference that it is unlikely, or beyond coincidence, that a number of similar events happened by chance. Tendency evidence is central to multiple intra-family infant death prosecutions because there is often evidence of other incidents of harm or abuse/maltreatment, or because there are other similar incidents which might lead to coincidence reasoning – implicating the accused. This type of evidence is often labelled propensity and similar fact evidence, respectively, at common law.

Sections 97, 98, and 101 of the Act regulate the admission and use of tendency and coincidence evidence and reasoning, as exceptions to a general prohibition against these types of evidence. Tendency evidence, covered by s 97, states:

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[627] Where there is no objection, the evidence is normally admitted.
[628] Cole, S, 'Splitting Hairs? Evaluating 'Split Testimony' as an approach to the problem of Forensic Expert Evidence' (2011) 33 *Sydney Law Review* 459-485.

(1) Evidence of the character, reputation or conduct of a person, or a tendency that a person has or had, is not admissible to prove that a person has or had a tendency (whether because of the person's character or otherwise) to act in a particular way, or to have a particular state of mind unless:

(b) the court thinks that the evidence will, either by itself or having regard to other evidence adduced or to be adduced by the party seeking to adduce the evidence, have significant probative value.

Tendency evidence is adduced to demonstrate that the accused has a tendency to act in a particular manner. Tendency evidence often assumes significance because it is used to negate accident or uncertainty about injury or death.

Coincidence evidence, covered by s 98, states that:

(1) Evidence that two or more events occurred is not admissible to prove that a person did a particular act or had a particular state of mind on the basis that, having regard to any similarities in the events or the circumstances in which they occurred, or any similarities in both the events and the circumstances in which they occurred, it is improbable that the events occurred coincidentally unless:

(b) the court thinks that the evidence will, either by itself or having regard to other evidence adduced or to be adduced by the party seeking to adduce the evidence, have significant probative value.

Coincidence evidence is adduced to prove that, because of the improbability of two or more similar events occurring by coincidence, the accused committed an act and/or had a particular state of mind. The coincidence rule focuses specifically on circumstances, usually similar to the charged offence, to support the allegation that the accused has

acted in a similar manner on other occasions.

When the prosecution adduces tendency and/or coincidence evidence, it must satisfy the further requirement that tendency and coincidence evidence is inadmissible against an accused person 'unless the probative value of the evidence substantially outweighs any prejudicial effect it may have on the defendant'. This is prescribed by s 101.[629]

> *Tendency evidence about a defendant, or coincidence evidence about a defendant, that is adduced by the prosecution cannot be used against the defendant unless the probative value of the evidence substantially outweighs any prejudicial effect it may have on the defendant.*

In order to persuade the trial judge that the probative value of the prosecution evidence is greater than its prejudicial effect, the prosecution has to demonstrate how the evidence satisfies ss 97 and/or 98 and 101 of the Act.[630]

R v Ellis[631] was a conviction for multiple counts of break enters and steals. Ellis unsuccessfully appealed, on the grounds that the fact of each robbery was wrongly admitted as tendency or coincidence evidence in relation to the other offences. *Ellis* established that the probative value provision calls for a *balancing* exercise conducted on the facts of each case, after considering the actual prejudice, which the probative value of the evidence must substantially outweigh. It has been held that there 'may well be cases where, on the facts, it would not be open to conclude that the probative value

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[629] ss 97, 98, and 101 Uniform Evidence Law. At common law, before the Uniform evidence acts, the High Court ruled that the evidence must be so probative that 'it bears no reasonable explanation other than the inculpation of the accused in the offence charged'. This was a very high standard and was not reflected in the text or interpretations of the Act. Note that *Matthey* was decided under this more onerous and exclusionary regime.

[630] *Pfennig v The Queen* (1994) 182 CLR 461; [1995] HCA 7 (the evidence must be so probative that 'it bears no reasonable explanation other than the inculpation of the accused in the offence charged' at [481]).

[631] *R v Ellis* (2003) 58 NSWLR 700; [2003] NSWCCA 319.

of particular evidence substantially outweighs its prejudicial effect, unless the 'no rational explanation' test were satisfied'.[632] In relation to coincidence evidence, it will be more probative if there are 'striking' similarities. After *Ellis*, the critical test became s 101 of the Act.

The value of this type of evidence lies in its demonstration that the behaviour for which the accused on trial is recurrent. Examples of this type of evidence include evidence of prior alleged sexual abuse of other children or prior convictions for sexual offences. While there is significant risk with admitting these types of evidence, as the potential to contaminate a trial is high because the evidence of other acts may not be related or relevant to the act being prosecuted, in cases of sexual assault of children, the evidence can be highly probative.[633] However, the probative value of tendency evidence in cases of multiple intra-family death cases is uncertain, as there is no reliable evidence that a homicide has taken place in *any* of the deaths. This argues against relying on tendency and coincidence reasoning particularly in SUDI cases in the absence of other kinds of genuinely probative evidence.

9.1.5 Application of the law of evidence to SUDI trials

In SUDI trials, the criminal justice aim of achieving factual rectitude is hampered by the equivocal empirical support for medical determinations about the mechanism of death. This affects the reliability or trustworthiness of many opinions, which in turn ought to impact on assessments of whether the evidence has a potentially prejudicial effect. The

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[632] Ibid 631, *Ellis,* [96] per Spigelman CJ.
[633] Hamer, D, 'Admissibility and use of relationship evidence in HML v The Queen: One step forward, two steps back' (2008) 32 *Criminal Law Journal* 351-368. Hamer concludes 'HML appears to be a clear authority that the defendant's uncharged sexual offences against the complainant is admissible for a propensity purpose, and is then also usable to provide context' 367.

earlier reviews of the medical literature on smothering and shaking indicate that frequently there is no independent corroboration of what actually caused an infant's death. In a situation where the expert does not know if his or her opinion is correct or whether their methods are valid, there are significant obstacles to achieving a correct verdict and considerable risk of admitting prejudicial opinion evidence masquerading as medical knowledge.

Medical witnesses primarily give opinion evidence, which involves interpretation of physical and/or psychosocial evidence. The Act requires that the expert's opinion, admitted on the basis that the expert has specialised knowledge based on training, study or experience, is based 'wholly or substantially on that knowledge'. There is no doubt that medical experts testifying in SUDI trials have experience and 'specialised knowledge'. However, it is difficult to assess whether any opinion is based on their specialised knowledge or is speculative. Two High Court judgments have held that the expert providing an opinion must explain to the court the basis of their evidence and the underlying facts upon which it is based. In *HG v The Queen*,[634] an appeal against conviction for sexual intercourse with a child, the exclusion by the trial judge of defence expert evidence that the child's father committed the acts at an earlier date, was challenged. In rejecting the appeal, Gleeson CJ said:

> *An expert whose opinion is sought to be tendered should differentiate between the assumed facts upon which the opinion is based, and the opinion in question …By directing attention to whether an opinion is wholly or substantially based on specialised knowledge based on training, study or*

[634] *HG v The Queen* [1999] 197 CLR 414.

experience, the section requires that the opinion is presented in a form which makes it possible to answer that question.[635]

The ruling places responsibility on the expert to demonstrate the assumptions underlying their opinion evidence so that the court can determine whether the evidence is within the expertise of the expert. Gleeson CJ held that opinion evidence in *HG* was:

...based on a combination of speculation, inference, personal and second-hand views as to the credibility of the complainant, and a process of reasoning which went well beyond the field of expertise.[636]

These comments are relevant for medical opinion evidence in SUDI cases, as the expert does not always explain the basis for the opinion. Gleeson CJ added that an expert's opinion should be confined to their expertise, in accordance with s 79:

Experts who venture 'opinions', (sometimes merely their own inference of fact), outside their field of specialised knowledge may invest those opinions with a spurious appearance of authority, and legitimate processes of fact-finding may be subverted.[637]

In the second High Court case, *Dasreef Pty Ltd v Hawchar*[638] an appeal was made by Dasreef under s 79 regarding a medical report relied on by the plaintiff to support his case. The plaintiff had developed silicosis while working in a situation in which he was exposed to silica dust. He had relied on the medical report to assist in proving his case that silicosis had developed from excessive dust exposure. The tribunal had implicitly admitted and relied on the report to calculate the quantity of dust respired

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[635] Ibid, 427.
[636] *HG v The Queen* (S67-1998) [1999] HCA 2 at 41.
[637] Ibid, 44.
[638] *Dasreef Pty Ltd v Hawchar* [2011] HCA 21.

by the plaintiff, although the expert testified that he was only commenting on the appropriate precautions that should be taken when exposed to silica dust. The court upheld the appeal and ruled the report inadmissible. Both appeals held that expert opinion must be provided in a manner that enables the court to understand the basis of the evidence and the underlying reasoning leading to the opinion. The opinion would be admitted only if it remained within the expert's knowledge in all elements comprising the evidence. In SUDI cases, the complex mix of medical and psychosocial evidence obscures the extent to which the expert's opinion is drawn from their specialised field of experience, namely medicine. Many medical experts believe that non-medical or contextual evidence is relevant to forming their opinion, despite experts such as Cordner cautioning that contextual matters in a case, while important, ought not to be relied on by pathologists, especially if such information is controversial or unrelated to the autopsy findings. Even when reliance on non-medical evidence is explicitly excluded at pre-trial, there is no reason to believe that the expert has not made inferences based on this evidence. The appeals discussed in the thesis suggest that medical experts have engaged in speculation under the guise of the authority bestowed on them by the court as witnesses proffering 'specialised knowledge' (or expertise). If the court applies s 79 stringently, it is possible that inadmissible inferences might be detected as the expert is required to explain their opinion in detail and in a manner that makes the underlying reasoning transparent to the court.

Experience, another basis for admitting expert evidence, is itself a vague construct that does not elucidate whether the experience has assisted the expert to become reliable and accurate in their opinions. As one legal commentator observed, in relation to forensic science evidence:

> *... when there are real-world, practice-based empirically unambiguous indices of success or failure in coming to one's conclusions, we might rationally rely upon experience not only to provide the expert's data base, but also to authenticate the reliability of the conclusory skills involved ...in circumstances when experience alone does not resolve the main doubts about reliability, it would be irrational, and therefore an abuse of discretion to rely upon it.*[639]

Expertise derived from experience is not a substitute for an analysis of the reliability of opinion evidence proffered. This is even more so when a group of experienced experts rely on each other's experience to confirm their methodology and opinion, as the reliability of these practices and opinions are unknown. A unique problem with medical opinion evidence in SUDI cases is that there is rarely any feedback as to whether the expert's opinion is correct.[640] Under these conditions, it is possible that an experienced expert has formed unreliable or inaccurate opinions without any awareness of errors in their thinking, despite considerable training, study and experience. The potential for misleading testimony is significant. Yet formal qualifications and experience continue to provide the basis upon which expert evidence is admitted to trials and is one of the key considerations in appellate reviews of SUDI cases in which medical opinion evidence is the subject of the appeal. Irrespective of the fact that individuals with credentials and/or experience are able to express their opinions at trial, if the expert cannot do what is claimed or their ability to perform the task is not much higher than chance, their opinion is not logically relevant and should not be admitted. Qualifications or experience or use of an accepted technique does not mean the opinion has probative value. Specialised knowledge gained from training or experience may be unreliable or

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[639] Risinger, D.M, 'Defining the 'Task at Hand': Non-science Forensic Science after Kumho Tire v Carmicheal' (2000) 57 *Washington & Lee Law Review* 767-800 776.
[640] See Chapter 7 for an in-depth discussion of the role of experience in expertise development.

misleading to the court. Clinical opinion evidence is not based on a set of systematic and standardised processes that enable comparisons between experts' opinions and the reasons of differences in opinion. This makes it difficult for the fact-finder to understand how and why the expert has formed a particular opinion. The fact-finder may not be apprised of the methodology and reasoning underlying expert opinion, which in turn affects the fact-finder's ability to assess its reliability or trustworthiness.[641] The reliability problem is exacerbated when there is conflicting expert opinion, as the absence of criteria to judge opinion evidence in the first place affects the fact-finder's ability to compare different opinions. Expert evidence that lacks indicators of reliability is likely to mislead, rather than assist the court, as has been the case in the wrongful conviction cases of SUDI. Expert disagreement often leads the judge to admit the evidence and leave it for the jury to hear and resolve.[642] Judges, and parties, rarely attempt to ascertain whether any disagreement is justified.

Recent legal scholarship reveals increasing concerns about the reliability and potentially unfairly prejudicial effect of admitting incriminating expert opinion evidence, whether in forensic science or medicine, and the inadequacies of current criminal trial procedures to credibly manage expert evidence.[643] Similarly, the Canadian Supreme Court and several provincial courts have also expressed concern about reliability of incriminating expert opinion evidence. In *R v Trochym*,[644] Deschamp J endorsed the importance of considering reliability in admissibility decisions, observing

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[641] Interestingly, these are often most conspicuous in civil cases where large repeat players (such as insurers and manufacturers) have the resources to contest expert evidence.
[642] Occasionally experts are asked to produce a joint report or try 'hot tubbing' (concurrent expert evidence). These measures can assist in resolving expert disagreement but not necessarily the reliability of the opinions admitted to trial.
[643] See generally Edmond, G, and San Roque, M, 'The cool crucible: Forensic science and medicine evidence and the frailty of the criminal trial' (2012), In press.
[644] *R v Trochym* [2007] 1 SCR 239.

that:

> *...evidence that is not sufficiently reliable is likely to undermine the fundamental fairness of the criminal process.*[645]

The existing expert evidence admissibility standards seem to be inadequate. They are rarely applied rigorously by a judge, which serves to obscure problems with expert evidence. There is a tendency to admit expert evidence, even when there are concerns about its reliability or potential to mislead. This can occur through pre-negotiated constraints on incriminating expert opinion in which an expert's opinion is admitted with controls imposed on the opinion, estimates of probability or grades of certainty. This approach, however, conceals the lack of rigour on the part of the expert in forming their opinion. If the original opinion was not demonstrably reliable, weaker assertions are not necessarily more reliable. If the technique is invalid, has significant error or the error rate is unknown, or is compromised by the expert's knowledge of other, irrelevant case facts, then imposing constraints on the expert's opinion as an 'admissibility compromise' is inappropriate or misleading.[646] An attenuated opinion is not a substitute for opinion evidence that is demonstrably reliable. For example, in *Anthony*, Meadow had diagnosed Anthony with Munchausen's Syndrome by Proxy (MSbP), which was excluded from the trial. However, there is no reason to believe that Meadow was *not* influenced by his excluded diagnosis in determining the mechanism of death in each child's case. If there was concern about the MSbP diagnosis, conceivably *all* Meadow's evidence should have been excluded, as this type of compromise does not render the

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[645] Ibid 624 at [27]; see also *R v Mohan* (1994) 2 SCR 9; *R v DD* (2000) 2 SCR 275; *R v J-LJ* (2000) 2 SCR 600; *Re Truscott* (2007) ONCA 575.
[646] Ibid 628; Ibid n 643.

remaining evidence more trustworthy. It also means that the court has admitted evidence that is vulnerable to cognitive bias and contamination in terms of the expert's reasoning, potentially admitting evidence that is misleading. The appellate court ultimately overturned Anthony's conviction. Interestingly, the appeal heard new evidence that indicated that genetic factors were a rational explanation that could account for the recurrent deaths. The mechanism had nothing to do with MSbP.

One of the challenges in managing medical opinion evidence, once it has been admitted, is that it is an opinion based on many factors, including physical and psychosocial evidence, as well as the expert's own experience and knowledge of death investigations. These are often nebulous, particularly the psychosocial factors, which have to be teased out in the trial—often with uncertain success. Forensic pathologists, such as Australian Stephen Cordner, caution against medical opinion on the mechanism of death being based on psychosocial issues, as that is not within the expertise of a physician and of uncertain value in establishing the mechanism of death. He also advocates for a greater willingness on the part of medical experts to state that they do not know how an infant died (similar to Goudge's expectation of circumspection), rather than forcing certainty by relying on an amalgam of physical and psychosocial variables. Cordner's observations raise the issue of whether incriminating expert opinion based on tenuous grounds should be admitted at all to a criminal trial, rather than leaving it to the jury to grapple with complex evidence about which even medical experts disagree. If there is a situation in which there is strong physical evidence of homicide or prior, proven physical violence toward the child – that is an actual behaviour rather than inferred intent to harm – even if medical opinion evidence is inconclusive, it is possible to say the child did not die of other causes, such as infection. The failed appeals in *Kai-Whitewind* and *Oyediran* were predicated on other evidence, deemed cogent by the

court, that the parents had harmed the infant in the past. In Kai-Whitewind's case, she had spoken about killing her infant, had not bonded well with him, might have delayed reporting his death, and had chosen not to give evidence.[647] Similarly, in *Oyediran*, there was extensive evidence of previous physical abuse towards the infant and denial of the actual injuries to the infant.

In multiple infant death trials, across jurisdictions, the fact of each infant's death is relied on to prove that *all* the infants' deaths constitute homicide. The admission of opinion evidence of tendency and coincidence is central to a prosecution case that multiple infant deaths constitute homicide. If opinion evidence, medical or psychosocial, admitted via ss 76 and 79, is used to satisfy ss 97, 98 and 101, the question is whether that opinion evidence satisfies these sections of evidence law: that is, does the opinion evidence establish tendency and coincidence in the fact of several deaths as inculpatory? The admission of coincidence evidence in cases such as *Clark*, *Cannings* and *Folbigg*, is a departure from the historical reticence to use evidence of a person's disposition, or evidence of chance, except in the most unambiguous situations.[648] In these trials, the prosecution persuaded the court to admit evidence of past events and/or the fact of each child's death and allowed it to be used on the basis that such evidence either shows that the accused has a 'tendency' to act in a criminal manner or has a proclivity to commit homicide, or that it is no coincidence that several infants have died in the family of the accused, arguing, effectively, that 'lightening does not strike twice', and each death must be homicide. Courts in these cases have accepted that the medical evidence about the circumstances of each infant's death is relevant to the determination of whether each

[647] Ibid n 8, *Kai-Whitewind*.
[648] E.g. Ibid n 630 *Pfennig*; [1995] HCA 7.

death was inflicted and whether the accused committed the criminal acts that led to their deaths. This is despite ambiguity in the medical literature about the relevance and meaning of multiple intra-family infant deaths from unascertained causes.

An important aim of the criminal trial procedure and underlying value system is to minimise the risk of convicting an innocent person. Under both statute and common law, courts must be careful about admitting evidence that can be misused or invested with unjustified weight by the tribunal of fact. However, in SUDI cases, the threshold for including expert medical evidence by the court was set at a remarkably low standard. It was left to the jury to decide on medical facts about which even credible experts, in each trial, disagreed. Medical opinions were admitted despite most mainstream medical opinion doubting the significance of much of the medical speculation in the context of previous miscarriages of justice. This raises the problem of how to manage qualified experts who are willing to venture opinions that are unreliable or speculative. The tension between experts willing to make meaningful inferences about multiple unascertained deaths and those who are more reticent creates a situation in which there is substantive disagreement between equally qualified experts. The accused is likely to bear the brunt of the risk when expert disagreements are left for the jury to resolve – especially if the expert opinions adduced by the state are speculative. One approach is to impose reliability thresholds that are stringently applied. Additionally, when there is substantive disagreement between qualified experts, this might be an adequate basis on some occasions for withholding the evidence from the jury.[649] There is provision within the Act to exclude this type of evidence through s 137 and, perhaps, s 79(1). The

[649] The UK cases of *Cannings* or *Clarke* seemed to suggest as much before it was read down in *Harris & Ors*.

challenge will be in determining the reliability of medical opinion evidence, a task that must be informed by the medical community.

The quashed convictions in *Clark* and *Canning* seriously question the value of admitting tendency and coincidence evidence in many multiple intra-family infant death cases. The challenge is determining the conditions under which the fact of several infant deaths in one family can be rationally used to establish that each death constitutes homicide. Theoretically, possible rational forms of proof would be, *in each case*, physical evidence of inflicted suffocation, no other known the mechanism of death and a history of physical abuse; and/or psychosocial factors, such as a stated desire to harm each child, a history of psychological or behavioural evidence of pervasive explosive temper, impulsivity and unwillingness to learn to respond appropriately to each infant's needs; and a confession properly obtained. Although reliability standards are not imposed on expert evidence in most common law jurisdictions, ideally each form of evidence, whether physical or psychosocial, would need to be demonstrably reliable in order to satisfy a rational approach to including the evidence as proof of tendency and/or coincidence. From an epistemic point of view, the class of evidence, whether physical or psychological, is less significant than whether these findings reliably differentiate between homicide and other causes of death. If a rational approach to proof is adopted, in the majority of cases the fact of unascertained death(s) cannot be used to suggest homicide, as the deaths are each unascertained and the fact of multiple deaths does not prove or necessarily support an allegation of homicide.[650] The jury in cases such as *Folbigg* were required to determine whether each of the four deaths alone and/or together

[650] It may not exclude or be inconsistent with it, however. In the current state of medical knowledge, there may be limited meaning to be drawn from the fact of several unascertained deaths in one family.

constitute(d) homicide, despite medical uncertainty about the mechanism of death in each case. If they were satisfied that one child was intentionally killed or injured, they were able to use tendency and/or coincidence reasoning to infer that all of the injuries were inflicted. Some of the experts expressed, or sought to express (and therefore were committed to), opinions that implied a tendency or the lack of coincidence between the multiple deaths. It is doubtful whether it is appropriate to leave such evidence and assertions to a jury to decide, if there is no confirmation of homicide in each case and no medical basis for drawing inferences. While the jury is entitled to use all evidence presented to decide the mechanism of death/injury, the risk is that the medical opinion evidence and other case evidence is of uncertain reliability and might mislead the jury. It is unknown whether the perspective of all evidence presented at trial increases the reliability of the medical opinion evidence. Given the resource-related and rebuttal difficulties usually faced by the defence and the prosecution attempts to prove guilt, thereby biasing an interpretation of the evidence towards guilt, it is difficult to see how issues relating to unreliability would be exposed to the jury. The potential for irrational and prejudicial reasoning is unacceptably high and, arguably, would not satisfy the criteria for applying tendency and coincidence rules. One possibility is to admit deaths that are unascertained but provide judicial instructions to counter any potentially prejudicial influence. However, there is no reason to believe that this measure would effectively protect against irrational or unfairly prejudicial reasoning on the part of the fact-finder. The risk of an unfair trial is ultimately too great without reliable medical evidence of homicide and/or highly probative evidence of abuse. Approaching the problem of medical opinion evidence in terms of whether *each* death on its own has reliable evidence of homicide and whether that evidence is sufficient to sustain the burden of proof might be a better way to proceed. A possible solution might be to

conduct an individual trial for each death that does meet these criteria and only admit evidence of other homicides once a jury has convicted on a single count. Ultimately, there is no rational basis for admitting incriminating expert opinion of uncertain probative value, as it fails to satisfy rules for its inclusion and seems likely to constitute unfair prejudice to the accused.

The legal safeguard of excluding evidence of coincidence or tendency should be set at a higher standard than has been the case in multiple infant death cases, such as *Clarke*, *Cannings* and *Folbigg*. Section 101 of the Act states that to admit evidence of coincidence and/or tendency, its probative value must substantially outweigh any prejudicial effect. In cases where there is a combination of speculative and potentially unreliable expert opinions being used for the purposes of coincidence and tendency, there are substantial risks that the evidence so used will mislead the court.

A conspicuous exception to the liberal admission of medical opinion evidence regarding multiple intra-family infant deaths is the case of *Matthey*, in which much of the incriminating prosecution expert opinion was excluded, resulting in the case being dropped by the Crown. Coldrey J made several observations in *Matthey* that ought to be taken into account when a trial judge assesses whether prosecution medical opinion evidence should be admitted on the basis of coincidence reasoning in infant death trials. Firstly, Coldrey J commented:

> *Experts can point to the rarity of four unexpected and unexplained deaths in the one family on the basis of their experience and knowledge of the literature, but to utilise that factor in allocating*

a cause of death in an individual case is to engage in impermissible "coincidence reasoning" of the type apparently disapproved of by Barr J in Folbigg.[651]

In *Folbigg,* prosecution medical experts relied on coincidence reasoning to justify their interpretation of the fact of four deaths in one family, despite Barr J's ruling. The following two examples illustrate medical opinion evidence that was ostensibly excluded at the pre-trial hearing, being expressed by medical experts. Professor Herdson (qualified as a non-scientific expert) testified:

Based on all the material that I have reviewed relating to these four infant deaths, in my opinion all four infants probably died from intentional suffocation.[652]

There was no empirical literature to support Herdson's opinion nor was there conclusive evidence of deliberate suffocation in each infant's death.[653] Similarly, Dr Susan Beal, a paediatrician qualified on the basis of her clinical experience, stated:

Based on the records I have examined in regards to the family Folbigg, I have no hesitation in saying I believe that all four siblings were murdered … As far as I am aware, there has never been three or more deaths from SIDS in the one family anywhere in the world, although some families, later proved to have murdered their infants, had infants who were originally classified as SIDS.[654]

Beal's comments seem to rely on the medical literature that, as the earlier analysis of smothering deaths suggest, is not based on independent corroboration of homicide.

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[651] Ibid n 9, *Matthey*, 188. This decision was made under Pfennig, before the evidence act was enacted in Victoria. See *R v Pfennig* (No 1) 1992 57 SASR 507, 481.
[652] Ibid n 9, *Folbigg*, 47.
[653] Section 80(a) does not preclude the judge excluding evidence where it trespasses on the ultimate issue. Where the expert evidence is speculative, contaminated by psychosocial factors and cannot be credibly exposed in trial, it *may* be appropriate to exclude on this basis.
[654] Ibid n 9, *Folbigg*, 48.

Rather the apparent deaths later 'proven' to be homicide were the product of speculative opinion and case meetings aimed at consensus, not accuracy of case ascertainment or reliability. In an apparent truism, Coldrey J defended the exclusion of medical evidence interpreting multiple deaths as proof of homicide:

> *The rarity of the phenomenon of four unexpected and seemingly unexplained deaths in one family cannot, of itself, provide a cause of death.*[655]

Lastly, Coldrey J concluded that:

> *We recognise that the occurrence of three sudden and unexpected infant deaths in the same family is very rare… and therefore demands an investigation into their causes…great care must be taken not to allow the rarity of these sad events, standing on their own, to be subsumed into an assumption or virtual assumption that the dead infants were deliberately killed, or consciously or unconsciously to regard the inability of the defendant to provide some convincing explanation for these deaths as providing a measure of support for the prosecution case. If on examination of all the evidence every possible known cause has been excluded, the cause remains unknown.*[656]

Recurrent SUDI in one family are rare but a rare event does not necessarily imply an inflicted cause. However, within the context of a highly emotive trial process, the legal expectation that the fact-finder must be rational and rely on objective facts can be overridden by medical suspicion and insinuation that the infants were deliberately killed. Medical suspicion, especially where improperly supported by ambiguous psychosocial factors, is well below the standard of proof required in a trial, yet forensic pathologists or paediatricians have frequently speculated that death was inflicted in the absence of actual physical evidence of homicide. Additionally, there is a problem of double

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[655] Ibid n 9, *Matthey*, 191.
[656] Ibid n 9, *Matthey*, 177.

counting when relying on psychosocial evidence. The jury are exposed to the psychosocial evidence, as well as apparently independent medical evidence of an expert, which itself may also have been influenced by psychosocial evidence. This double counting may not be exposed to the jury. Consequently, the medical evidence is not necessarily independent corroboration of homicide.

9.1.6 Trial safeguards

It has been argued that 'wrongful convictions demonstrate that the burden and standard of proof, even in conjunction with other trial safeguards, can and do fail'.[657] Achieving factual rectitude is the foundation of a rational criminal trial process.[658] The state's duty in a criminal trial is to ensure a factually accurate outcome in which the trial has been conducted in a substantially fair manner. Consequently, several safeguards in the trial process aim to reduce the risk of unfair prejudice and wrongful conviction. These include cross-examination, judicial discretions and warnings, prosecutorial restraint and defence rebuttal experts. Safeguards attempt to ensure the trial is conducted with due regard for procedural and evidentiary fairness, and rectitude, as the accused is entitled to procedural accuracy. Procedural reforms to reduce partisanship – through court-appointed experts, concurrent evidence, shared or joint experts and pre-trial meetings – do not necessarily address reliability and accuracy of incriminating expert opinion, both of which are fundamental elements of procedural accuracy. Courts have tended to admit incriminating expert opinion and left determinations of the probative value (or weight) for the fact-finder to resolve. Judges and lawyers, and as a result, appellate judges, seem

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[657] Edmond, G, and Roberts, A, 'Procedural fairness, the criminal trial and forensic science and medicine' (2011) 33 *Sydney Law Review* 359-394, 384.
[658] See Ibid n 58, Twining; Ho, H.L, *A Philosophy of Evidence Law: Justice in the Search for Truth* (Oxford: Oxford University Press, 2008).

to trust the efficacy of trial safeguards, despite growing concerns about limitations of these measures to overcome problems with the reception and evaluation of expert evidence, particularly whether incriminating expert opinion is reliable or trustworthy. The asymmetrical distribution of resources between the prosecution and defence and the way in which the prosecution constructs its story can make the case appear more persuasive than it actually is. This raises serious questions about the efficacy of existing trial processes to render fair and factually accurate judgments.

Cross-examination that is effective can contribute to securing accurate verdicts. However, the influence of cross-examination has been overstated when it is directed at expert testimony.[659] There is empirical evidence that suggests cross-examination may be ineffective in exposing and conveying limitations and exaggeration in expert evidence.[660] Cross-examination is not always successful in repairing the effect of misleading or speculative expert testimony on examination-in-chief (i.e. direct), irrespective of the quality of the examination or problems with testimony, and defence cross-examination has been equally unsuccessful in altering the impact of direct expert testimony. Cross-examination by defence lawyers can fail to address significant deficits in expert evidence, such as methodological and inferential aspects of expert evidence, while experts have been successful in preserving their opinion by appeals to their experience and personal authority. In the face of incriminating expert opinion, defence lawyers have found it difficult to effectively contest substantial issues in the testimony. The kinds of issues raised in this thesis are rarely raised, let alone conveyed, through

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[659] See generally, Lynch, M, and Bogen, D, *The Spectacle of History: Speech, Text and Memory at the Iran-Contra Hearings* (Duke University Press, 1996).
[660] See McQuiston-Surrett, D, and Saks, M.J, 'The Testimony of Forensic Identification Science: What Expert Witnesses Say and What Factfinders Hear' (2009) 33 *Law and Human Behavior* 436, 439.

cross-examination (or rebuttal witnesses or judicial directions and warnings). Even if cross-examination is effective, it is not clear that the fact-finder will appreciate problems with expert evidence, especially if other aspects of the prosecution evidence shore up expert evidence that is unreliable.

Another potential safeguard is calling rebuttal experts to counteract the opinions of prosecution expert witnesses. The use of rebuttal experts depends on the defence having adequate resources, the availability of experts and their evidence being admitted. Judges have admitted incriminating expert opinion believing that cross-examination and rebuttal experts can effectively reveal or, at least, explore problems with the evidence, such as whether it is reliable and accurate, in a similar manner to credibility assessments. However, empirical evidence has not supported this judicial belief.[661] The value of rebuttal evidence depends on the technical proficiency of the defence lawyer and his or her ability to expose limitations or flaws in prosecution expert testimony. A complication with medical opinion evidence in SUDI is the lack of information on the reliability and accuracy of the death investigation and interpretation. In this context, the defence is unlikely to uncover evidentiary problems and provide, through questioning the rebuttal expert, strategies for the jury to apply in their consideration of the expert evidence. Furthermore, the prosecution expert opinion will be integrated into an incriminating prosecution narrative, which is likely to persist in its persuasive power, despite cross-examination or opposing opinion from a defence expert. It is not clear to the jury that prosecution experts are often closely involved with police

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[661] Lieberman, J, and Sales, B, 'The effectiveness of jury instructions' In: Abbott, W, and Batt, J, (eds) *A Handbook of jury research* (American Law Institute, American Bar Association, 1999) 182–187; Brewer, N, and Williams, K, *Psychology and law: An empirical perspective* (New York, Guilford, 2005); Ibid n 606.

and prosecutors in death investigation and preparation of the evidence for trial. Consequently, the defence expert can seem conspicuously biased while assuming, wrongly, that the prosecution expert(s) is not. Another complication is that admission of prosecution evidence places the prosecution at an advantage by allowing evidence of little or unknown probative value and expecting the defence to negate it in some way. Given that the state, via the prosecutor, is accusing an individual of a crime it seems unreasonable to expect the accused to show that the evidence is unreliable. That should be the role of the side that is adducing the evidence – the prosecution.

Judicial instructions, warnings and directions are considered to be methods for achieving a rational and fair trial. In the case of jury trials, it is expected that the trial judge will direct the jury about the criminal standard of proof, beyond reasonable doubt, which tends to involve contrasting it with the standard of proof in civil proceedings. The question of whether the jury understands the limitations and unfairly prejudicial elements of medical opinion evidence is important, given that the jury is entitled to consider *all* evidence presented at trial and is expected to apply the criminal standard of proof to it, unless instructed otherwise. There is extensive empirical literature suggesting instructions, warnings and directions are ineffective, especially when delivered at the end of the trial.[662] More importantly, the way the jury approaches expert evidence, when it is fundamental to the case and there is conflict between the various opinions, requires particular attention to be paid to instructions and warnings given to the jury.[663] The problem is that there may be limited or no guidance to assist the trial judge in instructing the jury how to resolve differences in expert opinion, beyond instructing the jury to be

[662] Ibid.
[663] The Court explicitly acknowledged this point in *Henderson & Ors* 13.

careful and to examine the conflicting evidence in the context of all evidence adduced at the trial.

The concerns about trial safeguards do not mean they cannot be effective. However, the rate of success is insufficient to protect the defence against prosecution expert opinion that appears to represent specialised knowledge and is persuasive in the face of suspicion of the rebuttal expert's motives. Furthermore, if judges are willing to admit unreliable expert evidence, there may be genuine concerns about their ability to understand the potential dangers of unreliable expert evidence and effectively communicate it to the jury.

The presumption of innocence and right to procedural accuracy in criminal law is associated with an expectation that the prosecution will discharge its duty by adopting an appropriately sceptical or protective attitude towards the accused. These ethical responsibilities stem from a longstanding belief that it is not the role of the prosecutor to obtain a conviction by any means,[664] as the prosecutor has a duty to act as the minister of justice.[665] This requires an ethical stance by the prosecutor so that the accused is assumed to be innocent until found guilty. An aspect of this duty is that the prosecution should seek to adduce the most reliable evidence that will promote accuracy of decision-making, including evidence that has probative value, which in practical terms must be reliable opinion evidence. Therefore, the prosecution is expected to examine and adduce evidence, even if the expert's testimony reduces its probative value, instead of only evidence that supports the prosecution case. If the case relies substantially on expert evidence, the presumption of innocence framework might require the prosecution to

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[664] *Nyron Smith v The Queen* [2008] UKPC 34; *Randall v The Queen* [2002] 1 WLR 2237.
[665] *Boucher v The Queen* (1954) 110 Can CC 263, 270.

refrain from proceeding to trial if the evidence is speculative.[666] This is because an individual should not be expected to defend him or herself unless the prosecution produces sufficient evidence to prove a *prima facie* case. In order to do this, the prosecution evidence must pass thresholds that promote accurate decision-making.

There is considerable pressure on legal safeguards to identify, address and convey problems with expert evidence. As reliability is not evaluated in admissibility decisions, the jury may be unaware evidence may be unreliable or vulnerable to problems that mislead the jury in their deliberations. For many juries, the state's reliance on and admission of evidence may imply reliability. Empirical research casts doubt on the efficacy of trial safeguards to inform the jury of problems with expert evidence.[667] Safeguards may obscure or elide the actual limitations of incriminating expert opinion and leave lay juries to assign weight to expert opinion, despite there being methodological tools available to assess the validity and reliability of techniques underlying expert evidence, as well as degrees of error and their proficiency.[668] Typically, the jury is not informed that the prosecution has relatively greater access to resources than the defence. The absence of this contextual information might affect the jury's perception of the facts in a given case, in favour of the prosecution. That is, the jury might assume that the lack of an effective rebuttal from the defence means that incriminating expert opinion is dependable and there is no disagreement or controversy among reputable experts.

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[666] Ibid n 28, 241.
[667] Ibid n 661; Ogloff J.R.P, and Rose V.G, 'The Comprehension of Jury Instructions' In Brewer, N, and Williams, K.D, (eds). *Psychology & The Law: An Empirical Perspective* (Guildford Press, 2005); New South Wales Law Reform Commission, *Jury Directions* (2008) Consultation Paper No 4.
[668] Ibid n 643, 11.

There is limited evidence from the cases examined in this thesis that legal safeguards perform their intended function of ensuring that only evidence probative of guilt is presented to the jury. Judicial directions do not necessarily capture or convey problems in medical opinion evidence to the jury and the approach that should be taken when deliberating about medical evidence in the context of the overall trial. This includes the ongoing disagreement within the wider medical community about determining the mechanism of death in SUDI and the need for caution in relying on medical evidence. Most significantly, directions might not convey that qualified experts' experience is an insufficient basis upon which to judge the merits of the content of their opinion. Edmond and San Roque have commented that:

> *When it comes to assessing the admissibility of a technique or derivative opinion (or interpretation) the experience of the analyst cannot overcome the failure to systematically study the technique in circumstances where the correct answers (i.e. ground truth) are known so that the reliability and validity can be ascertained.*[669]

The problem with medical opinion evidence is that, once admitted, there is no scope for the jury to be advised that there are problems with the actual *capability* of the expert to identify the mechanism of death, even though the expert is formally qualified as an expert. Juries do not necessarily appreciate, either via judicial directions or otherwise, that the accuracy of a particular opinion on the mechanism of death cannot be measured against a correct reference point. In the absence of feedback on accuracy of the mechanism of death assignment in SUDI, it is difficult for juries to assess whether admitted medical opinion evidence is relevant or reliable, or whether it should have any

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[669] Ibid n 643, 3.

bearing on their deliberations on the accused's alleged guilt. Effectively, by their admissibility decisions, courts have limited access to the state of medical knowledge in the wider medical community rendering courtroom knowledge artificial or not indexed to limitations of medical opinion evidence. Under these circumstances, admitting medical opinion evidence is unwise in the first place and trial safeguards are unlikely to effectively prevent misleading the jury about this type of evidence. Ultimately, it leads to greater responsibility and risks for the poorly resourced defence.

9.1.7 Code of expert conduct

Another ostensible safeguard to the admission of unreliable incriminating expert opinion evidence is the code of conduct for experts appearing in legal proceedings. In Australia there is an unambiguous (civil) code of practice that states the expert witnesses' duty to the court:

> **2 General duty to the court**
>
> (1) An expert witness has an overriding duty to assist the court impartially on matters relevant to the expert witness's area of expertise.
>
> (2) An expert witness's paramount duty is to the court and not to any party to the proceedings (including the person retaining the expert witness).
>
> (3) An expert witness is not an advocate for a party.[670]

The code also requires that an expert report will include:

> (a) the facts, and assumptions of fact, on which the opinions in the report are based …

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[670] Uniform Civil Procedure Rules 2005 (NSW) Sch 7, 2 and Practice Direction: Guidelines for Expert Witnesses in Proceedings in the Federal Court of Australia (2008). Recently, in *R v Wood* [2012] NSWCCA 21 the expert code of conduct was considered in depth. Although a breach of the code did not make the expert's evidence inadmissible, the Court held that under s 135 and s 137 judges can exercise their discretion to exclude expert evidence if 'the probative value of the evidence being substantially outweighed by the danger that it might mislead or confuse or be unfairly prejudicial to a party', at 729. Notably, there is no similar formal requirement for experts to conform to a code of conduct in the criminal jurisdiction in Victoria.

(b) the expert's reasons for each opinion expressed,

(c) if applicable, that a particular issue falls outside the expert's field of expertise,

(d) any literature or other materials utilised in support of the opinions,

(e) any examinations, tests or other investigations on which the expert has relied, including details of the qualifications of the person who carried them out …

(2) If an expert witness who prepares an expert's report believes that it may be incomplete or inaccurate without some qualification, the qualification must be stated in the report,

(3) If an expert witness considers that his or her opinion is not a concluded opinion because of insufficient research or insufficient data or for any other reason, this must be stated when the opinion is expressed.[671]

Experts are expected to conform to this code, whether in criminal or civil jurisdictions, which confirms judicial aversion to partisanship or adversarial bias in expert testimony. Similarly, both the UK and Canadian codes for expert conduct echo the stipulations in the Australian code.[672] Inherent in these codes is a predominant expectation that the expert's purpose is to educate the court about matters outside its expertise in an impartial manner. Irrespective of these rules, some medical experts in SUDI trials have failed to apply these standards to their testimony. In the UK, after Clark's conviction was quashed, an application to the General Medical Council by the family led to Meadow being deregistered. Similarly, Smith clearly failed to adhere to the code in his testimony, something Smith himself admitted during the Goudge Inquiry. However, there were many medical experts in the trials examined in this thesis who proffered opinion

[671] Ibid n 670, Sch 7, 5(1), (2) and (3).
[672] Civil Procedure Rules Part 35.3, Criminal Justice Procedure Rules Part 33.2. Expert Witness Year Book 2012. Source: www.gmc-uk.org; Rules Amending the Federal Courts Rules (Expert Witnesses). *Rule 52.2* Code of Conduct for Expert Witnesses.

evidence that breached these guidelines to some extent by failing to advise the court of the limitations of their evidence and the lack of empirical support for assertions of conclusive proof of homicide. Perhaps the most important information that should have been disclosed to courts – that there is limited verification of the mechanism of death in either alleged smothering or triad deaths – was noticeably missing, albeit some experts, such as Australian pathologist Cordner, did do so. This type of information is essential for the trier-of-fact in determining whether an infant death constitutes homicide. References to experience or study do not address the issue of the reliability of medical opinion about the mechanism of death. Peer agreement has been cited as proof of reliability or accuracy of opinion by both the experts themselves, and to some extent, appellate judges. Even more troubling is the phenomenon of medical experts citing criminal convictions as proof of homicide when their evidence formed part of the evidence upon which the jury based its verdict. In the absence of independent corroboration of the mechanism of death, these sources of proof are likely to be misleading and, ultimately, contribute to the admission of unreliable medical opinion evidence.

9.1.8 Jury decision-making

The fact-finder, whether judge or jury, must decide the case on a combination of all evidence at trial and that evidence must be proven to the criminal standard of proof, beyond reasonable doubt. The jury is required to base their judgment only on the evidence presented, which may not be all that there is to know about a particular case. The question is whether, once admitted, problems with expert evidence and other evidence presented at trial and are understood by jurors. For example, in *Folbigg*, if medical opinion evidence or experts do not strongly support a finding of homicide,

should ambiguous – though prejudicial – psychosocial evidence, such as her personal diaries have been admitted at all? As the jury will be unaware of these evidentiary problems, unless the defence can identify, expose and convey them through cross-examination and/or a competing expert, it is highly likely that their appraisal of evidence will be affected by the absence of information regarding problems with medical opinion evidence. When expert opinion, admitted specifically to assist the fact-finder in their task, involves evidence that is complex, it is difficult to see how, in practical terms, the expert might impart sufficient knowledge to the jury to help it evaluate the conflicting opinions in the context of adversarial trial procedure.[673] Two particular concerns relevant to SUDI trials are the way in which jurors react to medical opinion evidence and the implications of trial evidence that seeks to prove the prosecution theory, rather than establishing what actually happened to the deceased infant. Psychological research provides some insights into the former issue, while recent legal commentary on the prosecution of SUDI cases reveals the difficulty of the juror's task in SUDI trials.

9.1.8.1 Psychological research on juror responses to expert evidence

Criminal trials involve dense and disconnected information presented in a combination of question and answer and narrative styles by the prosecution and defence. The juror must process and synthesise evidence into a coherent structure to render a verdict. An extensive body of psychological research demonstrates that juries do not approach trial evidence in the rational manner expected of them by the law.[674] Jurors are relatively

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[673] Roberts, P, and Zuckerman, A, *Criminal Evidence* (Oxford University Press, 2004) 294–5; Hand, L 'Historical and Practical Considerations Regarding Expert Testimony' (1901) 15 *Harvard Law Review* 40.

[674] See Vidmar, N, 'Expert Evidence, the Adversary System, and the Jury' (2005) Supplement 195(S1) *American Journal of Public Health* S137-143.

more likely to be persuaded by certain types of expert testimony.[675] An exhaustive review of research on juror reasoning and behaviour in response to complex evidence and competing expert opinions in a trial concluded that, while juries can and do deliberate conscientiously and in detail, they can also be misled and confused by statistical and other complex information.[676] In experimental studies, mock jurors have reported difficulties in reasoning about statistical, actuarial, or probabilistic evidence and the inferences that can be drawn from such evidence.[677] Similar difficulties have been noted in other samples.[678] An analysis of the way in which actual jurors on capital juries handle trial deliberation found jurors made three consistent criticisms: (a) experts were viewed as 'hired guns'; (b) they were sceptical of experts and their ability to explain; and (c) experts often failed to draw a link between their testimony and the defendant's specific situation.[679] Jurors rated experts as more credible and influential when they made a connection between their testimony and the specific facts of the case. Both judges and psychology students, participating in experiments, gave more weight to concrete, or explained in detail evidence, than to statistical evidence.[680] This is consistent with research suggesting that scientists and other highly trained individuals also become

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[675] Kemp, R, Heidecker, S, and Johnston, N, 'Identification of Suspects from Video: Facial Mapping Experts and the Impact of their Evidence' (Paper presented at the 18th Conference of the European Association of Psychology and Law, Maastricht University, 4–5 July 2008).
[676] Vidmar, N, Lempert, R.O, Diamond, S.S, Hans, V.P, Landsman, S, MacCoun, R, et al, 'Amicus Brief: *Kumho Tire v Carmichael*' (2000) 24 *Law & Human Behaviour* 387-400.
[677] Faigman, D.L, and Baglioni, A.J, 'Bayes' theorem in the trial process: Instructing jurors on the value of statistical evidence' (1988) 12 *Law and Human Behaviour* 1-17; Krauss, D.A, and Sales, B, 'The effects of clinical and scientific expert testimony on juror decision-making in capital sentencing' (2001) 7 *Psychology, Public Policy, and Law* 267-310.
[678] Hans, V.P, and Ivkovich, K.K, 'How jurors evaluate experts' (1994) 28 *Trial Lawyers Forum* 5-9.
[679] Sundby, S, 'The jury as critic: an empirical look at how capital juries perceive expert and law testimony' (1997) 83 *Virginia Law Review* 1109-1188.
[680] Wells, G.L, 'Naked statistical evidence of liability: Is subjective probability enough?' (1992) 62 *Journal of Personality & Social Psychology* 739-752.

confused by statistical evidence and place greater weight on anecdotal information, such as clinical opinion testimony.[681]

Evidence complexity can displace juror attention from testimony content to more superficial factors. When scientific evidence gets exceptionally complex, credibility cues, such as expert credentials, have an especially strong influence on how juries resolve conflicting expert opinion.[682] Expert's credentials or their mere presence can be more influential than the content of their testimony, when jurors process complex evidence.[683] One explanation for this preference is that when they are unable to process information systematically or in-depth, people resort to heuristics,[684] or engage in peripheral processing[685] that does not focus on testimony content. Instead, individuals use cognitive shortcuts to determine the persuasiveness of the message (e.g. number of arguments, source expertise), suggesting an interaction between testimony complexity and juror's capacity to carefully scrutinise information.[686]

It has not been clearly established the conditions under which jurors most effectively process complex scientific or other technical testimony. However, there is no doubt that complex, conflicting testimony is difficult to process, especially in the truncated manner in which it is presented in trials. The indications from psychological

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[681] Ibid n 676.
[682] Shuman, D, and Sales, B, 'The admissibility of expert testimony based upon clinical judgment and scientific research' (1998) 4 *Psychology, Public Policy, and Law* 1226-1252.
[683] Cooper, J, Bennett, E.A, and Sukel, H.L, 'Complex scientific testimony: How do jurors make decisions?' (1996) 20 *Law & Human Behaviour* 397-394; Cooper, J, and Neuhaus, I.M, 'The "hired gun" effect: Assessing the effect of pay, frequency of testifying, and credentials on the perception of expert testimony' (2000) 24 *Law & Human Behaviour* 149-171; Greenberg, J, and Wursten, A, 'The psychologist and the psychiatrist as expert witnesses: Perceived credibility and influence' (1988) 19 *Professional Psychology: Research and Practice* 373-378.
[684] Chaiken, S, 'Heuristic versus systematic information processing and the use of source versus message cues in persuasion' (1980) 39 *Journal of Personality and Social Psychology* 752-766.
[685] Petty, R.E, Cacioppo, J.T, and Goldman, R, 'Personal involvement as a determinant of argument persuasion' (1981) 41 *Journal of Personality and Social Psychology* 847-855.
[686] Ibid n 683.

research are that the way in which expert opinion is presented to the jury affects their judgment, a fact that ought to be incorporated into evidentiary admission and trial management decisions. This has not been the case to date in SUDI trials, which involve not only complex but also conflicting testimony from a vast array of medical experts.

Gross, a legal scholar described the challenge for the juror when processing complex evidence as unenviable as it is paradoxical.[687] Lay jurors are expected to evaluate expert testimony, which is introduced because the jurors *lack* the expert's specialised knowledge and experience in a particular field. This problem is exacerbated when there are disputes between experts. There is very little to guide jurors in resolving conflicting expert evidence, a significant element of deliberation, when the experts themselves are unable to resolve these differences.[688] Often jurors are left to decide on issues that are controversial and disputed in the wider expert community beyond the court. Similarly, other commentators have observed there are 'crucial steps that a non-expert judge or jury is…not capable of performing in an epistemically non-arbitrary manner',[689] and the illogical assumption that a juror, without the expert's specialised knowledge, can rationally evaluate the expert's evidence.[690] These concerns were expressed over a century ago when Learned Hand commented:

> *The trouble with all this is that it is setting the jury to decide, where doctors disagree. The whole object of the expert is to tell the jury... general truths derived from his specialized experience. But how can the jury judge between two statements each founded upon an experience confessedly*

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[687] Gross, S.R, 'Expert Evidence' (1991) 1113 *Wisconsin Law Review*1185-86, 1182.
[688] Ibid, 1183.
[689] Brewer, S, 'Scientific Expert Testimony and Intellectual Due Process' (1998) 107(6) *Yale Law Journal* 1535-1681, 1680.
[690] Mnookin, J. L, 'Expert Evidence, Partisanship, and Epistemic Competence' (2008) 73 *Brooklyn Law Review* 1009-1014, 1012.

foreign in kind to their own? What hope have the jury, or any other layman, of a rational decision between two such conflicting statements each based upon such experience.[691]

The limited ability a juror has to 'discriminate between reliable and unreliable experts' is a prevalent concern in more recent legal commentary.[692]

The criminal trial process, as it stands, does not assist the juror to rationally evaluate medical opinion evidence in SUDI trials. There is no analysis of expert evidence quality – only the rules of evidence that need to be satisfied, which is set at a low threshold. The jury is not apprised of wider debate in the medical community about smothering and triad deaths, beyond the evidence presented to them. They are required to determine facts that are out of context with no vehicle to navigate evidence of considerable complexity. A factually correct verdict, based on rational deliberation of expert (and other) evidence, depends to a large extent on guidance to both the judiciary and the jury in SUDI trials in how to approach this task.

9.1.8.2 The effect of adversarial trial process on evidence before juries

A characteristic of the adversarial trial is that the jury hears evidence that supports the prosecution case.[693] Theoretically, effective rebuttal experts or cross-examination of prosecution witnesses should reveal problems with medical opinion evidence to the jury. This is rarely the case and, in the context of the trial, may be ineffective. In relation to triad deaths, one legal scholar, Tuerkheimer, observed that the jury 'cannot be expected to divine scientific truths from an evidentiary lacuna',[694] in which the wider context of

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[691] Ibid n 673, 54-55.
[692] Ibid n 690, 1013.
[693] Tuerkheimer, D, 'Science-Dependent Prosecution and the Problem of Epistemic Contingency: A Study of Shaken Baby Syndrome' (2011) 62 *Alabama Law Review* 513-569.
[694] Ibid, 523.

medical discourse about triad deaths is not exposed to the fact-finder. There is an enormous burden on jurors to reason through complex and unresolved – but seemingly persuasive – prosecution evidence, without the benefit of balancing evidence on limitations of the shaking hypothesis, which can persuade a juror (wrongly) to convict. When the jury is exposed to incomplete or misleading evidence, there are significant risks that their verdict does not have a rational basis, thereby producing legally illegitimate decisions. One solution is to have independent panels of experts advising the trial judge at the admissibility stage so that an informed decision can be made about the reliability and value of prosecution expert evidence before it is presented to the jury.[695]

9.1.9 Appellate review

Appellate review of trial verdicts focuses primarily on the evidence presented at trial. However, as appellate courts have limited information about the basis for the jury's decision or elements of their deliberation, any review is necessarily limited. The appellate process consists of reviewing trials in ways that might be better characterised as formal rather than substantial fairness.[696] Despite the concern that expert evidence admitted to trials is incomplete, confusing and lacking in the wider contextual information relevant and necessary to understanding such evidence, the review proceeds on the assumption that the jury has the capability to correctly understand trial evidence and any judicial instructions (and perhaps some limitations with expert evidence, even when they are not developed). Appellate review does not perform a qualitative examination informed by empirical knowledge about the evidence beyond what is

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[695] This was read down in *Henderson & Ors*, 217.
[696] See Ibid n 58, Twining; Ibid n 597, 598, Duff et al; Ibid n 602, Jackson & Summers; Ibid 643, 7.

known to the court, as it is not allowed to do so. The emphasis is on whether the conduct of the trial conformed to legal procedural rules and processes and a review of facts proffered to the trial, rather than whether the jury was exposed to available knowledge in expert communities outside the trial process. As appellate courts usually focus on legal technical issues, they are dependent on counsel's submissions. Consequently, the appellate court is subject to the same evidentiary limitations and potential reasoning problems as the jury, which is an obstacle to a fair and comprehensive review of the evidence against the appellant. The reviews in all the cases discussed in the thesis, such as *Folbigg, Harris & Ors*, and *Henderson*[697] *& Ors*, did not investigate the limitations of the experts' evidence or attempt to resolve expert disagreements in any rationally meaningful manner. The criteria for accepting an expert's opinion were based on factors such as general acceptance of opinion or expert qualifications, rather than an analysis of the reliability and accuracy of testimony content. There was no application of knowledge from psychological research that fact-finders find certain types of testimony difficult to process and apply appropriately to their deliberations.

The tendency of appellate courts to defer to trial judges' admissibility decisions and exercise of discretions is unjustified when there is empirical evidence available about the reliability of the technique and consequent opinion of an expert. Appeals judges should themselves review the reasons expert evidence was admitted and the reliability of such evidence. Without a review of the reliability and accuracy of expert evidence and its basis, appellate judgment is vulnerable to being influenced by misleading or irrelevant expert evidence embedded in a prosecution narrative in much the same manner as the jury. The probative value of medical – and other incriminating

[697] Except, very unusually, in *Henderson*, which received new evidence on appeal.

– expert evidence and its reliability ought to be a concern for appellate judges, as it has:

> *...the potential to generate substantial unfair prejudice to the accused (and produce mistaken convictions). The admission of such opinions threaten to undermine the burden and standard of proof; for it can be very difficult to expose limitations, especially where a very eminent or experienced expert expresses incriminating opinions in very confident terms.*[698]

Both trial and appeals courts have failed to detect and respond to the problems in medical opinion evidence, as well as in forensic science evidence. The results of the Goudge Inquiry, which revealed that unreliable medical opinion evidence was proffered for years before the mistakes from such evidence, particularly wrongful convictions, were exposed, confirm the concerns raised by legal commentators. The appellate judgments examined in this thesis suggest that there is no reason to believe the problem is localised to Ontario or England.

The appellate process itself also influences debate in the wider medical community. Medical experts seeking to corroborate their opinion that fatal shaking causes the triad or that covert homicide underlies apparent SIDS deaths have cited appellate courts' decisions as proof of the accuracy of their view.[699] However, the appellate process does not, and indeed in its current form cannot, conduct a proper review of medical techniques and methodologies or of resultant opinions. As there is no review of the reliability and accuracy of expert evidence, at trial or at appeal, and there is often no correct answer as to how the death occurred, against which medical opinion

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[698] Edmonds G, 'Actual innocents? Legal limitations and their implications for forensic science and medicine' (2011) 43:2-3 *Australian Journal of Forensic Sciences* 177-212, 198.

[699] See for example Ibid n 98, Meadow, 10; Richards, P.G, Bertocci, G. E, Bonshek, R.E, et al 'Shaken Baby Syndrome' (2006) 91 *Archives of Diseases in Childhood* 205-206*;* Hobbs, C.J, and Bilo, R.A.C, 'Responses to the Letters of Drs Geddes & Squier' (2009) 39 *Pediatric Radiology* 760-761, citing *Harris & Ors* judgment as proof that the accepted hypothesis still stands.

evidence can be measured, it is difficult to see how appellate judgments could constitute corroboration of medical opinion evidence in any given case. The tendency of appellate courts to analyse medical opinion evidence by deferring to authority based on experience or peer agreement does not address whether the medical opinion evidence in question is reliable. This approach to expert evidence is inadequate, in a context in which there is escalating concern that such evidence is misleading courts and contributing to wrongful convictions.

9.1.10 Developments in expert evidence law

Two comprehensive judicial inquiries have examined problems with medical opinion evidence in SUDI. The Goudge Inquiry in Ontario into paediatric forensic pathology found that tribunals have accepted or admitted complex subjective or clinical experience-based opinions expressed by highly regarded medical experts as facts.[700] Similarly, the Law Commission of England and Wales Consultation paper on the admissibility of expert evidence in criminal proceedings [701] found that courts experienced problems in establishing the validity and reliability of medical evidence based on subjective medical opinion, such as that proffered in triad and smothering deaths, in infant homicide trials. The Commission proposed statutory changes to the admissibility criteria for expert opinion evidence, whether scientific or non-scientific, in an attempt to manage opinion evidence in criminal trials. [702] The Commission recommended that expert opinion evidence must be thoroughly evaluated for

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[700] The Goudge Inquiry was examined in Chapter 8, sub-section 8.3.2.
[701] See United Kingdom Law Commission, *The Admissibility of Expert Evidence in Criminal Proceedings in England and Wales: A New Approach to the Determination of Evidentiary Reliability*, Consultation Paper No 190 (2009), http://www.lawcom.gov.uk/docs/cp190.pdf viewed 26 March 2010; United Kingdom Law Commission Report (UKLCR), Law Comm No 325, Expert Evidence in Criminal Proceedings in England and Wales. (London, The Stationary Office, 2011).
[702] Ibid, UKLCR.

admissibility and the weight to be assigned to it at a pre-trial hearing conducted by the trial judge.[703]

The report is, however, problematic in that it has exempted experience-based (effectively, clinical experience) expertise from rigorous standards of reliability. Such exemptions run the risk of legitimating the *status quo*, and fail to assess the reliability of experience-based opinion evidence. Incriminating expert evidence needs to be demonstrably reliable, regardless of whether it is scientific or not. Non-scientific expert opinion can and should be assessed for reliability relying on methodology relevant to that type of opinion evidence. In Canada, in *Trochym* [704] there has been acknowledgement that unreliable expert evidence is linked to the risk of wrongful convictions. However, as there is no universally agreed scientific method, legal scholars, Edmond and Roach, [705] have proposed a contextual approach that requires judicial evaluation of prosecution incriminating expert evidence to ensure it is based on current knowledge and limitations of the relevant area of expertise. The task of supporting evidentiary reliability ought to be restored to the state, rather than shifting the burden to the accused to disprove incriminating expert evidence or deal with unfair prejudice introduced by admission of unreliable expert evidence or expert evidence of unknown reliability. [706] The SUDI cases have seen medical opinion evidence of unknown reliability being admitted and the burden of proof being, effectively, shifted onto the accused to prove their innocence. In this way, medical and legal responses to death investigation and criminal trials, respectively, have contributed to wrongful convictions.

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[703] Ibid ,UKLCR; see also, Ibid n 8, *Henderson*.
[704] Ibid n 644.
[705] Edmond, G, and Roach, K, 'A contextual approach to the admissibility of the state's forensic science and medical evidence' (2011) 61 *University of Toronto Law Journal* 343 – 409.
[706] Ibid.

In these cases, not only has the medical evidence been of uncertain reliability, associated psychosocial factors, of at least as uncertain reliability, have played a part in the medical and legal decision-making about whether the death constitutes homicide.

The problem with smothering or triad trials is the lack of independent corroboration that the expert's opinion about the mechanism of death is correct. Evidence that could substantiate a suspicion that a death constitutes homicide include witnessed events preceding death or non-medical evidence, such as the presence of a dog at the death scene when the deceased has apparent stab or bite marks. The reliability of opinion based on these factors can be readily ascertained. The need for an independent reference point against which opinions can be tested cannot be overstated, as this process helps to verify that the expert's opinion is accurate and reliable. Many SUDI cases are characterised by evidence that lacks an objective standard, independent of the expert's opinions, against which suspicions of homicide can be corroborated. This leaves the potential for error at an unacceptably high level.

Trial judges should be required to assess the reliability of *all* forms of expert evidence, and act as gatekeepers who take responsibility for the quality of evidence presented to the jury. This approach would require the judge to ensure that the evidence continues to be presented in an accurate and reliable manner through the course of the trial. The cases of wrongful conviction have revealed many errors, primarily in incriminating prosecution medical opinion evidence relied on to prove homicide. Medical inquiries have found that medical experts have given misleading testimony in SUDI trials, the conduct of infant death investigation and inferences about the mechanism of death has lacked oversight, accountability and standardised protocols, and the experts and courts did not detect and prevent erroneous assumptions about the mechanism of death from being presented to the jury. These and other findings apply to

medical experts who are paediatric pathologists as well as those specialising in child protection. The problems were evident in various jurisdictions and were not specific to particular medical experts. Legal reform developments in England and Wales have recommended changes in the admissibility rules regulating expert evidence to incorporate reliability evaluations without which medical opinion evidence is vulnerable to being misunderstood in a trial context.

9.2 Conclusions

The aim of the criminal trial is to achieve factual rectitude, expressed by one commentator as 'doing justice in the pursuit of truth'.[707] The rules of evidence affect how the pursuit of truth is conducted. In common law countries, however, the rules of evidence that define how incriminating expert opinion evidence is admitted to the trial do not require the trial judge to determine the reliability or accuracy of this evidence. Generally, it is left to the jury to determine the weight to be accorded to expert evidence, despite there being disagreements between experts about the evidence itself. Currently, there is limited scope within the law of evidence to inform the jury of problems with medical opinion evidence, as well as that of associated psychosocial evidence. Legal safeguards (cross-examination, defence rebuttal experts, judicial warnings and directions, prosecutorial restraint) have not been effective in preventing the admission of unreliable incriminating expert opinion or incriminating expert opinion of unknown reliability in criminal trials for SUDI. Moreover, there is no way of knowing whether the evidence, and any limitations, is understood even when credibly raised.

[707] See Ibid 658; Ibid n 598; Ibid n 597; Ibid n 599; Ibid, n 602, Jackson.

An ongoing question is who determines whether expert evidence is reliable and can judges assess reliability? Ultimately, applying reliability standards relevant to the particular discipline, or sub-categories of a discipline, upon which expert evidence is based is an onerous task. Realistically, this task is unlikely to be effectively executed by busy judges under pressure to clear court lists and whose training dictates that the criteria for analysing and admitting expert evidence is general acceptance, authority from seniority, consensus or failures of logic. The type of information needed to accurately educate the fact-finder of elements of expert evidence that need to be understood to rationally reason through evidence at trial ought to be adduced by a panel of experts who represent the various methodologies used and areas of agreement and disagreement, who apply this knowledge to the specific case at the pre-trial hearing. The last point is particularly important, as general position statements do not effectively assist the court, as the judge is left to decide how the knowledge can be properly applied to evidence the prosecution seeks to adduce at trial. A report that applies existing knowledge to the proposed medical evidence explicitly, explaining how that evidence should be dealt with is necessary to properly assist the court. Such an expert panel would enable the judge, and ultimately the jury, to understand medical opinion evidence in sufficient depth and breadth for determining whether an infant death constitutes homicide by the accused. This process would assist the judge's consideration of evidence that should be admitted and also provide a rational basis upon which judicial directions and summing up can be based. Information provided by the panel would also assist the parties in examining witnesses. Representatives of the relevant professional specialty would have overseen expert evidence admitted to trial, which serves as an additional safeguard. A further measure ought to be that professional regulatory bodies be required to respond to instances of unreliable expert evidence in a trial, determined as departures from the

panel's evidence, rather than experts being immune to sanctions against conduct in legal proceedings. Medical experts should be expected to be reliable and accountable, regardless of whether the opinion is expressed in a clinical, research or legal context. A rigorous analysis of expert evidence and how it is presented to jurors, taking into account juror difficulties in reasoning about disputes that the experts themselves have not settled, and providing the jury with tools for assessing expert opinion can assist in achieving rational and fair determinations. These medico-legal safeguards have the potential to prevent miscarriages of justice in criminal trials for infant homicide, irrespective of the type of homicide involved.

Chapter 10:Conclusions and future directions

> *I tremble lest I have mankind at large for my enemies, so much doth wont and custom become a second nature. Doctrine, once sown, strikes deep its root, and respect for antiquity influences all men. Still, the die is cast, and my trust is in my love of truth, and the candour of cultivated minds.*[708]

The thesis has examined appellate judgments, medico-legal errors and wrongful or dubious convictions for infant homicide. While many factors contributed to the miscarriages of justice, medical opinion on the mechanism of death in sudden unexplained death in infancy (SUDI) was a core issue. The examination of the cases suggests that medical expertise was based on expert eminence and authority instead of demonstrably reliable and accurate investigation and conclusions about the mechanism of death. Longstanding medical beliefs prevailed in criminal trials despite limited, if any, proof that the beliefs were accurate, or supported by empirical research or independent corroboration that the death constitutes homicide. Despite a general shift in medicine towards an evidence-based approach to diagnosis and treatment, until recently medical investigation of SUDI had escaped critical scrutiny. There is no doubt that some parents murder their children. The reality is, nonetheless, that medicine's ability to identify homicide is far less certain than expert testimony in the appellate cases would imply. Current medical knowledge struggles to explain, reliably and accurately, the circumstances that lead an infant to die suddenly in their sleep or from a set of head injuries, despite such deaths being regularly attributed to alleged smothering and shaking, respectively. Paediatricians and pathologists have confidently asserted that the

[708] William Harvey, 'On the motion of the heart and blood in animals' (1628) *De Motu Cordis*.

mechanism of death can be accurately identified despite the empirical literature indicating that accurate ascertainment of cause of death is difficult in infants. In the absence of independent corroboration of their opinion, medical experts appear to have been misled by illusions of diagnostic accuracy that were bolstered by a group of like-minded peers who corroborated each other's opinions – in clinical and forensic settings. In effect, peer agreement has replaced independent corroboration that a death constitutes homicide. Parents and carers have been convicted – wrongly in several cases examined – on this type of medical speculation. The main legal test for admitting medical opinion evidence is that it must be relevant to the trial and be based on a specialised body of knowledge gained from study, training and experience that is outside the experience of the fact-finder. Based on these admissibility criteria, virtually all physicians would qualify as experts, irrespective of the reliability and accuracy of their opinions. Peer agreement simply strengthens the persuasive force of the collective testimony, despite the possibility that all the opinions are incorrect. A fundamental tenet of the adversarial criminal trial is that it should expose flaws in expert opinion evidence enabling the decision-maker to produce a sound verdict, an outcome that is not consistent with the miscarriages of justice examined in this thesis. The appellate courts have struggled to resolve and reason through conflicting medical opinion evidence, relying on reputation, peer agreement and experience to judge the merits of expert opinions. The wrongful convictions suggest that the trust medical and legal communities have invested in their respective methodologies seems to be misplaced. Once admitted, current legal safeguards have been unsuccessful in revealing problems in opinion evidence or the wider medical discourse about SUDI investigation. Medical regulatory and judicial investigations of the conduct of specific experts (Meadow in England and Smith in Ontario) revealed the many problems associated with medical investigation of SUDI. It

is unlikely that the problems with expert evidence are specific to particular experts, jurisdictions or countries. It is troubling that the inquiries revealed a lack of professional oversight and critical appraisal of expert conduct, despite the grave consequences of misleading or incorrect medical testimony. More disconcerting is the fact that neither legal nor medical regulatory mechanisms detected the flawed medical evidence that underpinned miscarriages of justice. In *Clark*, the review of Meadow's work resulted from a complaint by her father to the medical regulatory body, while concerns about Smith's work were known well before the Goudge Inquiry.

It is important to note that there *are* circumstances in which identified mechanism of death is likely to be more accurate. Witnessed events preceding death improves the chances of correctly identifying the mechanism of death. When there is evidence of developmentally unusual injuries, such as fractures and bruising, and/or previously confirmed abuse towards the deceased, it may be possible to conclude that there is a high index of suspicion the death constitutes homicide. Under these circumstances, courts may be able to convict but medical evidence ought to be stated in its limited terms.

When the physical findings are negligible – often the case with smothering – or there are unexplained fatal head injuries, the chances of wrongly attributing a death to homicide are high. In the absence of definitive findings, it is risky to remove an infant or prosecute a parent on the basis of medical and/or psychosocial suspicion and speculation.

The critical question then is whether homicide can be proven accurately in cases of SUDI. In both smothering and triad deaths, there is rarely independent corroboration that the mechanism of death is accurate. In both types of death, confessions and convictions have been relied on to confirm homicide. Confessions are unreliable, as the

circumstances in which they were obtained are often unknown. Convictions can be based on the medical opinion evidence of the same experts who refer to convictions as proof of homicide. The circularity of this reasoning poses dangers for accurately establishing how the death occurred. Neither uncorroborated expert opinion nor conviction ought to be relied on as corroboration of the other, as the decisions are not independent of each other.

10.1 Smothering

In possible smothering deaths, the task is to distinguish smothering from SIDS – the diagnosis when cause of death is undetermined or unascertained with 'cause' referring to both the medical cause and manner of death (homicide, accident, natural). In these cases, there is rarely medical or pathological evidence to assist identification of the mechanism of death. Instead, researchers such as Emery sought confirmation of suspected covert homicides from confessions and multidisciplinary confidential inquiries that met until consensus was reached. Emery did not independently corroborate the consensus decision of homicide but is the source of the oft-cited statistic that 2 – 10% of *any* SUDI population are covert homicide. It is difficult to know how the inquiries actually confirmed homicide. However, there is reason to doubt the judgment of experts who believe that any sample of SUDI has undetected or covert homicide, as confirmation biases are a real risk in these uncertain and catastrophic situations. The inquiries involved both medical and psychosocial evidence about the deaths. The reliance on psychosocial factors, such as quality of parental relationship and financial stress, is of dubious value, as psychosocial factors do not reliably discriminate between homicide and other causes of death.

SIDS recurrence studies, such as Carpenter's, have demonstrated that, although rare, recurrent SIDS deaths do occur in some families. Genetic or other unknown factors may explain these recurrent deaths. Compared to the general population, the risk of another SIDS death is higher in a family that has already had one SIDS death, and the risk is even higher in families with a trio of risk factors: maternal age < 25 years, multi-parous mother, and no waged income. Recurrence studies do, however, establish that several deaths can occur in one family. Whether the death or deaths constitute homicide is difficult to establish without positive pathology findings. Recurrent filicide is also rare. There is little empirical justification for interpreting recurrent SUDI – alone – as proof of homicide. Arguably, even the addition of psychosocial concerns might be insufficient evidence to shift from suspicion to proof of homicide.

Medical, legal and welfare literature has cited Emery's 2 – 10 % covert homicide estimate, propagating the view that covert homicide is undetected and unprosecuted in any sample of SUDI. This view was amplified by some physicians, such as DiMaio and Meadow, to justify their own speculation, or dogma, that mothers were 'getting away with murder', leading to the infamous, if misnamed, 'Meadow's Law' in cases of recurrent death. There is, however, no evidence in the empirical literature supporting these assertions. Proponents of undetected or covert homicide transformed ambiguous medical evidence of smothering from suspicion to certainty by reference to equally ambiguous psychosocial characteristics of the suspected perpetrator. The idea that covert homicide is detectable through psychosocial factors was disseminated by paediatricians, as was reliance on these variables as more accurate indicators of homicide than inconclusive pathology findings. However, non-significant medical results might equally indicate that death is *not* a case of homicide, as psychosocial factors are not specific to homicide.

10.1.1 Smothering appellate cases

Appellate cases against convictions for repeated intra-family smothering homicide in England and Wales, Australia, and Canada were examined. In each case, the first death was not thought to be suspicious by the examining pathologist. At best, the mechanism of death was undetermined. However, when the deaths were considered together before and during the trial, experts concluded and testified that all the deaths constituted homicide. This shift in opinion on the mechanism of death was not supported by empirical literature or medical evidence. Rather, the recurrent death means homicide dogma was evoked, erroneously leading to the admission to trial of the fact of each death based on coincidence and tendency reasoning, in *Clark*, *Cannings* and *Anthony*, and *Folbigg*. Remarkably, two Australian cases, *Phillips* and *Matthey*, did not go to trial after the trial judge rejected the prosecution application to try the deaths together determining that the prejudicial effect to the accused outweighed the probative value of the evidence. This shifting interpretation of the mechanism of death, from the initial autopsy to the eventual trial, is not specific to any one expert or country. The convictions of *Clark*, *Cannings* and *Anthony* were quashed due to concerns about the testimony of Meadow and other medical evidence. *Cannings* and *Anthony* benefited from the review of trials in which Meadow gave evidence after Clark's conviction was quashed. *Folbigg*, however, was not responsive to the concerns identified in medical testimony in the English appeals. Cunliffe concluded that *Folbigg* constitutes a wrongful conviction.[709] *Phillips* took place well before the English cases, while *Matthey* was after these appeals.

The willingness of Coldrey J, in *Matthey*, to exclude unreliable medical evidence, similar to the evidence in the English cases and *Folbigg*, is an exemplar of a

[709] Ibid n 15, 94.

rational legal approach to SUDI trials. At the time of *Matthey*, there was already discussion of the inculpatory meaning of recurrent SUDI in the medical literature but, to date, there is no independently corroborated proof that recurrent SUDI represents homicide. The admission of multiple counts of homicide, on coincidence reasoning, exposed juries to speculative and misleading medical opinion. The question is whether several deaths should have been considered together at all, given that recurrent deaths were documented in the literature. The admission of the fact of all deaths inevitably suggests each death is suspicious, despite the absence of any compelling empirical medical support for this view. It is not logically justifiable to conclude deaths constitute homicide because a medical or natural account is unavailable.

In *Matthey*, Coldrey J excluded medical evidence that was prejudicial, especially any medical evidence that relied on non-medical or psychosocial evidence. Coldrey J was influenced by the evidence of Victorian pathologist Cordner and also the concerns raised about the medical evidence in *Folbigg*.[710] Cordner cautioned against medical experts relying on psychosocial evidence, as that is not in the realm of their expertise, and emphasised the limited medical ability to explain why some infants die suddenly. Significantly, Coldrey J did not leave conflicting expert opinion for the jury to resolve, critically analysing and rejecting psychosocial or non-medical evidence that is often cumulative with medical evidence and represented as independent corroboration of homicide. A cautious medico-legal approach is necessary when ambiguous medical results are refracted through psychosocial information that is equally unclear.

Psychosocial factors have exerted considerable influence in convictions for smothering, in a context of inconclusive medical evidence. In the English appeals and

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[710] Ibid n 205.

Folbigg, medical experts presented psychosocial factors as inculpatory. Yet in the English cases, there was other medical evidence questioning the accuracy of the verdict. The successful appeals suggest that reliance on psychosocial factors in suspected smothering cases, especially if recurrent, is unsafe. Even in the case of *Kai-Whitewind*, whose appeal was dismissed due to cogent physical and psychosocial evidence beyond medical evidence, it is possible that concerning aspects of this mother's behaviour were not inculpatory. Rather, uncertain medical evidence was again bolstered by psychosocial factors of equally uncertain meaning. The recurrent SUDI constitutes murder dogma biased death investigation towards suspicions of homicide, which shaped interest in and interpretation of psychosocial evidence and vice versa. Both psychosocial and medical evidence ought to be demonstrably reliable and accurate, if further miscarriages of justice are to be avoided.

In *Clark*, the failure to disclose pathological evidence assisted the appellate review. Similarly, *Cannings* and *Anthony* benefitted from the post-*Clark* review of Meadow's evidence in SUDI trials. The Canadian appellate reviews in *Sherret-Robinson* and *Marquardt* had the benefit of an exhaustive analysis of Smith's conduct. In this sense, the appellate reviews were facilitated by the analysis of Meadow and Smith's work. However, appellate review ought to establish whether the content of the expert's opinion is demonstrably reliable and accurate, according to what is known – published scientific knowledge. The successful appeals in the UK and Canadian events took place after questions of serious misconduct were raised about the testimony of Meadow and Smith. Medical regulatory bodies ought to oversee physicians' conduct, rather than the families of the wrongly convicted, such as Clark. Medical experts should not to be immune to prosecution from forensic testimony, if improvements are to occur in the quality of medical testimony. Longstanding concerns about Smith's conduct led to a

judicial inquiry by Goudge J whose many recommendations included monitoring the performance of paediatric forensic pathologists, and improving training and oversight of the discipline. Medical discourse and research needs to focus on accurately confirming the mechanism of death in all cases, bearing in mind that confessions and convictions are not reliable proof of homicide.

10.2 Triad/SBS deaths

Unlike suspected smothering, there are physical findings in triad deaths but the cause of the triad is controversial. For decades, a triad of fatal head injuries (subdural and retinal haemorrhages (SDH and RH) and brain disease – encephalopathy) has been attributed to shaking or shaking and throwing an infant: the Shaken Baby Syndrome (SBS). It is assumed shaking causes the triad, so the triad is proof the infant was shaken. This inherently circular reasoning has persisted since Caffey's original (untested) hypothesis that shaking causes the triad.

Current medical literature on triad deaths is vast, complex and contradictory. The triad has been observed in accidental injury – witnessed short-distance falls – and from natural causes – re-haemorrhages from birth-related trauma – as well as in other medical conditions, even if rarely so. Confirmation of a causal link between shaking and the triad is, it seems, based on medical assumptions, confessions and convictions, rather than independent corroboration that shaking causes the triad. Existing research and clinical opinion demonstrates a correlation between the triad and *assumed*, not independently corroborated, shaking. As studies assume shaking causes the triad, even correlational studies are difficult to interpret. Research suggests there is a higher *frequency* of triad injuries in *assumed* shaken baby cases. To determine whether the triad is an unusual finding in infants, information about its population prevalence (base rate)

is required. RHs are found in as many as 46% of infants at birth, which resolves over several months. Therefore, RH is not unusual in neonates. RHs also make infants susceptible to further haemorrhages. The base rate for SDH is unknown. Descriptive or case series designs – the typical methodologies used in triad studies – do not address causality or prove that shaking causes the triad. In the absence of independent corroboration of the triad, the meaning of observed correlations between the triad and putative injury mechanisms is difficult to interpret. Despite ethical constraints on conducting triad research, the relatively subjective process of clinical judgment/opinion is not an adequate substitute for the methodological rigour of well-constructed research, clinical or otherwise. If clinical judgment is the only type of inquiry possible, future studies can improve methodology by using standardised assessment and classification of triad cases by researchers or clinicians who are blinded to the case they are evaluating. This would make case or descriptive studies more transparent and defensible.

Despite the cause of the triad being unknown to date, shaking advocates continue to assert that violent shaking, with or without throwing, causes the triad (the 'accepted' hypothesis). One research group, led by Geddes, a neuropathologist, hypothesised that reduced oxygenated blood to the brain, from *any* cause, might explain the triad – Geddes I and II – and should be further investigated. Geddes found that assumed shaken cases had thin film bleeds, suggesting smaller vein rupture, instead of the relatively deeper bleeds expected of bridging veins rupture, as suggested by the shaking hypothesis. Deep bleeding is rare even in assumed shaking cases. Geddes proposed a 'unified hypothesis' (Geddes III) suggesting that microscopic findings in natural and alleged shaking deaths might reflect a *cascade* of events, including raised blood pressure in the brain, and immaturity and loss of oxygenated blood supply to the brain, rather than shaking alone. Geddes III has been the subject of intense medical and

legal debate, with shaking advocates stridently rejecting this hypothesis without offering a viable alternative, other than reiterating that the triad is indicative of shaking death – again peer agreement rather than independent corroboration. Biochemical research, based on animals or anatomical replicas of humans, suggests the degree of force and velocity required to cause the triad should cause neck injuries, as well as affecting the brain. However, neck injuries have not been observed in assumed shaking cases. Notably, Geddes' examination of infant brain anatomy has opened the shaking debate to a wider medical audience than child abuse paediatricians who rely primarily on clinical judgment and assert their own and peers' previous experience as proof that shaking causes the triad. As the law depends so heavily on expert testimony, courts require guidance from the medical community to differentiate between high quality clinical opinion and research evidence, and speculation based on subjective clinical experience and belief. Reliably and accurately determining the aetiology of the triad depends on conducting research that systematically documents the conditions in which the triad is found across the infant population – a prospective, longitudinal population study. This type of information will help to understand individual differences in physiology, as well as disease states, response to trauma, and recovery or death.

10.2.1 Triad appellate cases

In the aftermath of the successful appeals in *Clark*, *Cannings* and *Anthony*, the English Attorney General ordered a review of all child death cases in which Meadow had given evidence. Some were referred to the Criminal Cases Review Commission and then to appeal. These cases were examined separately due to possible differences in case issues between smothering and triad deaths.

Given the controversy surrounding the triad aetiology, it is unsurprising the appeals focussed extensively on this issue. Medical experts opined that shaking causes the triad, proffering their clinical or practical experience or peer agreement as proof, without providing independent corroboration to support their conjectures. One can only assume that if independent corroboration were available, medical experts would testify about it, as it would be persuasive confirmation of their opinion.

The appeals examined a vast array of conflicting expert evidence on the triad. Geddes work was the subject of protracted analysis, especially Geddes III ('unified hypothesis'), as I and II were descriptive studies. In the absence of legal or medical indicia for assessing the reliability and accuracy of Geddes' work, judicial evaluation of medical opinion seemed to be based on the expert's credentials, general acceptance within the medical community, and current clinical experience, rather than testimony content. Given that shaking is as much a hypothesis as Geddes III, a fact acknowledged by the Court, it is not clear why the Court attributed greater weight or authority to agreement based on clinical experience and beliefs of testifying experts over the evidence of systematically documented research. The judges held ongoing clinical experience was a necessary foundation for developing expert knowledge. This reasoning assumes experience and accurate and reliable knowledge development are interchangeable constructs. The apparent judicial preference for clinical/practical over other types of medical evidence may be due to relevance (the opinion of a clinician being more applicable to the specific case being decided) and assigning relatively greater weight to proof from authority, based on the expert's credentials, rather than science or scientific methodology.

The Court is dependent on medical experts to accurately convey limitations and uncertainties in their opinions. The failure of medical experts to advise the court of

doubts about shaking might be due to their own lack of critical thinking or tacit acceptance of this aetiology. It is clear, however, that the *Harris* and *Henderson* courts were not apprised of the extent of disagreement about the cause of the triad in the wider medical community, beyond that presented by Geddes' work. By rejecting Geddes III, the Court has effectively applied the same flawed logic to the shaking hypothesis, as shaking proponents. A further complication occurred in the triad debate in the aftermath of the Court's response to Geddes. Shaking proponents in the medical community relied on the Court's judgements to reject or prove Geddes III is incorrect.

Beyond the unresolved and, on the current empirical knowledge, unresolvable aetiology of the triad, the *Henderson* court emphasised the need for improved evaluation of medical opinion evidence, especially in contentious areas in which there is likely to be conflicting expert testimony, instead of leaving it for the jury to resolve. The Court held that, before the trial, the judge must determine limitations of medical opinion evidence and only admit evidence that is vetted by experts rendering a joint statement on the agreed and disagreed facts of the case. The judge should use his/her power to exclude evidence that does not comply with providing the fact-finder with an understanding of the issues, the limitations, and the capacity of the expert to inform the Court of the worth of the evidence to be presented. These steps were seen as necessary precursors to a trial conducted on a rational basis so that the jury is directed appropriately and is able to logically reason through conflicting expert opinion. The importance of this approach cannot be overstated, if the jury is to render a correct verdict. The Court also emphasised that juries should be directed that an unknown cause ought to be considered and a conviction should not occur if such a possibility exists in their minds.

The smothering and triad appeals highlight the problems inherent in a legal system that does not impose reliability standards before admitting medical opinion

evidence. There is pervasive uncertainty in the empirical literature about the reliability and accuracy of medical opinion evidence in SUDI. This fact has not been disclosed to juries, contributing to miscarriages of justice. Accepting medical opinion evidence because some experts qualified by the court are in agreement is a poor substitute for reliable and accurate determination of the mechanism of death, if future miscarriage of justice is to be avoided. All evidence, both medical and non-medical, should be tested at pre-trial for reliability and accuracy. Ultimately courts need guidance on how to assess the reliability of medical opinion evidence in SUDI. This could be achieved via an advisory panel that informs the court about current research and understanding of triad deaths and applies this knowledge to the facts of the specific case.

10.3 Psychosocial factors

The empirical research on psychosocial correlates of filicide provides little guidance on the role of these issues in determining the mechanism of death. Psychosocial correlates of filicide are poorly understood and limited by methodological constraints, especially whether filicides are correctly identified, as confirmation of filicide largely depends on confessions and convictions. Death investigation, therefore, needs to proceed on a case-by-case basis, as there is insufficient evidence that psychosocial factors can discriminate between homicide and other deaths to trust their meaning in death investigation. As a causal relationship between psychosocial factors and filicide has not been proven, psychosocial factors have limited value in assisting the determination of the mechanism of death. Despite the nebulous nature of psychosocial factors, they are ubiquitous and deserve more extensive analysis than has been possible in this thesis. Any death investigation will inevitably become aware of psychosocial characteristics of the deceased's family and living circumstances. As it is impossible to exclude psychosocial

factors, medical experts need to clearly indicate the influence of these issues on their determination of the mechanism of death.

10.4 Psychology of expertise

Reconstructing events preceding death without independent verification of these events is vulnerable to bias and error and the accuracy of the reconstructed events are unknown. The decision-making context and intra-expert psychological factors in SUDI investigation affects the reliability and accuracy of expert opinion. The expert's learning environment is highly correlated with acquisition of expertise. Environments that provide cues that are uncertain and confusing, and in which feedback on accuracy is delayed or non-existent, are unlikely to facilitate expertise. Medical experts investigating SUDI are at a significant disadvantage to other physicians. The cases are rare and there is infrequent, if any, conclusive medical evidence. There is no objective measure against which decisions about the mechanism of death can be measured. This context affects the reliability and accuracy of medical decision-making. Experts might be experienced but it is possible that the experts have persisted in committing the same errors throughout their experience, as there is no independent corroboration that their decisions are correct. The reliance on peer review or 'normative' corroboration in SUDI investigation, often the only basis for knowledge acquisition, is beneficial if there is feedback on accuracy. As human judgment is prone to error due to psychological biases, especially in the SUDI type of context, the reliance on agreement with other experts in SUDI investigation might not promote skilled decision-making. As confidence develops with experience, irrespective of whether the experience is correct, experience and confidence are not good indicators of accuracy. Eminent experts can express their opinions confidently but this does not convey whether their opinion is accurate. Under these conditions, it is not

surprising that many experts have been overconfident about the accuracy of their beliefs – called the expert's 'illusion' of accuracy by Kahneman.

Confirmation biases are particularly likely if experts and their peers believe they are skilled at detecting covert homicide. Experts who specialise in diagnosing homicide are more likely to have a confirmation bias that results in preferring homicide to other explanations. Deferring to consensus to corroborate a medical decision might create an illusion of accuracy that is misleading, when reliability is better achieved from demonstrable support of homicide. Yet medical experts and the appellate courts have favoured medical opinions that conform to the majority of medical opinion, rather than evaluating whether the content of medical expert opinion is reliable and accurate.

The psychological literature on expertise suggests then that recurrent SUDI or triad death investigations do not afford clinicians the opportunity to develop expertise that enables accurate and reliable determinations of the mechanism of death. The dangers of unjustified confidence or overconfidence are high. Medical experts in SUDI investigations are likely to be vulnerable to an illusory sense that their confidence is based on evidence strength, rather than the potential confirmation biases that interfere with accurate decision-making. Reliance on peer agreement to corroborate opinions is likely to be error-prone within the small community of experts who deal with infant homicide – a problem exacerbated by appellate judges who also rely on peer agreement to resolve conflicting expert opinion.

Medical reasoning in SUDI is primarily a form of clinical judgment and is relatively subjective, despite medical tests being physical in nature. Clinical judgment is vulnerable to inconsistent application of decision rules and confirmation bias that renders the preferred hypothesis as more compelling than it actually is, as other disconfirming hypotheses are not properly considered. This means that clinical judgment

can vary between assessments. Research comparing mathematical models to clinical decision-making has shown that mathematical models apply decision rules more consistently than do clinicians. The problem for SUDI investigation is that mathematical models are as reliable as the data from which they are constructed. The available knowledge on SUDI is inadequate to construct models, lacking as it does reliable indicators of homicide and base rates of various signs of homicide. However, these insights suggest that consistently applying decision rules is important. The adoption of standardised investigative methodology, such as checklists or protocols applied internationally, better regulation and accreditation of medical experts involved with SUDI in forensic settings and perhaps the exclusion of some speculative opinions from the trial are ways in which the current problems might be addressed. A standardised investigative approach is likely to be more reliable than unstructured clinical decision-making, which lacks transparency about how the decision was reached.

Psychological sources of judgment error can be managed to some degree by strict reliability standards being imposed on medical opinion evidence admitted to a criminal trial. Medical education and regulations can help to address these concerns as well. However, the correction of these sources of error depends, in a large part, on the expert's ability to identify and correct thinking distortions.

Context can influence expert judgment through extraneous factors not directly relevant to the medical assignment of the mechanism of death, including psychosocial variables. Evidence-based decisions are essential in SUDI investigations. This comes from focussing only on the data relevant to the task (such as autopsy and histopathology results), while ignoring related but irrelevant information to protect from bias due to extraneous influences. Double counting – psychosocial factors influencing medical opinion and corroborating it, when the two are not independent of each other – is a

contextual bias that creates an illusion of opinion accuracy. However, experts can overcome bias if they gather more information, especially on rare conditions, apply standardised investigative procedures, rigorously examine alternative hypotheses, and are willing to conclude that cause is unknown unless there is conclusive proof of homicide. Medical opinion regarding SUDI should be expressed cautiously with acknowledgement that expertise is difficult to develop in this type of investigation and accuracy if often unknown. Overconfidence is a serious risk as experts might be – and, arguably, have been – lulled into a false sense of certainty that their opinion is accurate. Medical opinion evidence ought to reflect the lack of reliable and accurate indicators of homicide in current medical knowledge of SUDI. To achieve this aim, experts need to become aware of potential psychological biases and errors that might create an illusion of certainty and confidence in their judgment, when such a view is unjustified.

10.5 Inquiries into medical opinion evidence

Beyond the difficulties appellate courts have faced in resolving conflicting medical opinion and assessing its merits, inquiries into the conduct of Meadow and Smith (Goudge Inquiry) also revealed a multitude of problems in the investigation and prosecution of infant homicide. The issues range from limitations of current medical knowledge to explain SUDI to medical experts' decision overconfidence to a common law legal system that does not require judges to assess expert evidence for reliability. The inquiries found that pathologists and child abuse paediatricians tended to assume a suspicious stance in which it was not clear that alternative hypotheses to homicide were considered to a substantial extent, or if they were, the expert's evidence did not reveal how or why other hypotheses were rejected. Both types of physicians were often closely involved with the police and prosecution, making it likely that their opinions were

influenced by the predominant police/prosecution view (and vice versa). The pervasive lack of critical analysis of medical evidence, by the expert and other involved parties, effectively altered the presumption of innocence so that accused parents were required to prove they had *not* committed a crime.

The reviews strongly recommended that a standardised, evidence-based approach was essential if medical experts were to reach the level of transparency and reliability required by courts. The Goudge Inquiry recommended greater oversight and transparency in all aspects of SUDI investigation and prosecution and improved quality of medical training. The UK Law Commission also recommended improvements to expert evidence in criminal trials. A practice of recording and reporting *all* known information about the case, identifying facts that have informed judgments and those that have not, and explaining the reasoning that led to the mechanism of death identified, would assist the court to assess the extent to which the opinion is justified on the facts disclosed. Such an approach is also likely to force the expert to deliberately examine their decision-making process, which could ensure the expert resists speculation, limits his or her judgments to medical facts and avoids unjustified or unsubstantiated assertions of opinion. Furthermore, the integrity of medical opinion must be preserved, irrespective of any pressure or influence from those involved in the trial.[711] Medical opinion evidence is interpretive and differences between experts will occur and should not be seen as a sign of inaccuracy or poor opinion. In many cases, a mechanism of death might not be identified.

The inquiries did not, however, adequately address *how* the reliability and accuracy of medical opinion evidence is to be determined. Guidance ought to come from

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[711] Ibid n 586.

the medical community. The many experts who provided evidence for the Goudge Inquiry have begun a process that needs to be applied in practice, from death investigation to providing testimony at a criminal trial. The rarity of multiple or triad deaths is not in and of itself proof of the mechanism of death. The lack of independent corroboration means that experts do not get feedback about the accuracy of their judgments, a critical step in ensuring that expert opinion is reliable and valid. Both the appeals and inquiries revealed many experts who presented equivocal medical opinion evidence as proven or established fact, without balancing their testimony with information about the extent of disagreement and uncertainty in current medical discourse. There has been limited attention to the quality of research designs examining SUDI. Medical experts have, therefore, misled courts. However, Meadow and Smith, both subjects of medical regulatory and judicial review, were as much a sign as a cause and there are ongoing problems with this type of expert evidence, including the lack of reliability standards for admission of medical expertise.

10.6 Laws of evidence

In the absence of formal rules to assess evidentiary reliability, courts have applied the criteria of relevance, general acceptance of opinion and specialised knowledge and training to admit medical opinion evidence. Appeals courts, able only to assess the evidence proffered to it – as opposed to all that is known about a particular death – have been limited by admissibility rules and have applied these rules to assess and resolve conflicting medical opinion evidence. Appellate reviews of SUDI convictions were based on impressions of experts and whether there was agreement with other expert testimony, rather than an assessment of the content of medical opinion. Judges had trouble navigating scientific research methods and understanding medical knowledge.

As this situation is likely to continue, judges will require assistance in evaluating the content of expert evidence. The wrongful convictions suggest that the potential for miscarriages of justice is considerable, if medical opinion evidence is admitted and relied on in criminal trials – especially when combined with other, often prejudicial, evidence before lay juries.[712] Once expert evidence is admitted, there is little reason to trust the effectiveness of current trial or appellate legal safeguards. Therefore, courts ought to strictly control the admission of expert evidence, in a similar approach to that adopted in *Matthey*.

If criminal trials for infant homicide are to achieve the criminal justice aim of factual rectitude and convicting only the guilty, admissibility standards for expert evidence need to be overhauled and better procedures developed for informing the jury of limitations and problems in medical opinion evidence. The absence of reliability standards places considerable pressure on legal safeguards – cross-examination, rebuttal experts, prosecutorial restraint and judicial directions – to prevent miscarriages of justice. The pervasive methodological and epistemological problems evident in medical opinion evidence cannot be left to the jury to determine weight. It is unknown whether the evidence, and any limitations, is understood by the jury even when it is credibly raised. Other evidence, usually psychosocial and non-medical circumstantial evidence, upon which the jury can rely, has unknown reliability and relevance for determining whether a death constitutes homicide. In this situation, expert evidence ought to be vetted for reliability and accuracy. SUDI cases are rare, usually controversial and there is substantial, often irresolvable, conflicting expert opinion. In this situation, ideally, an

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[712] Ranson, D, 'Forensic experts and miscarriages of justice: The inquiry into paediatric forensic in Ontario' (2009) 17 *Journal of Legal Medicine* 22.

advisory mechanism, such as a panel of experts representing the various methodologies underpinning expertise, could be consulted. Both trial and appellate courts could refer questions of reliability of techniques and derivative opinions to the panel. The panel would enable the judge, and ultimately the jury, to understand medical opinion evidence in sufficient depth and breadth to determine whether an infant death constitutes homicide by the accused. The panel's advice could be applied at admissibility hearings, examination of evidence during the trial, judicial summation and directions and, if necessary, at an appeal. Representatives of the relevant professional specialty would have overseen expert evidence admitted to trial, which serves as an additional safeguard. A further measure ought to be that professional regulatory bodies be required to oversee and respond to instances of unreliable expert evidence in a trial, determined as departures from the panel's advice, rather than experts being immune to sanctions against conduct in legal proceedings. Medical experts should be expected to be reliable, accurate and accountable, regardless of whether the opinion is expressed in a clinical, research or legal context. A rigorous analysis of expert evidence and how it is presented to jurors, taking into account juror difficulties in reasoning through unresolved expert conflict, and providing the jury with tools for assessing expert opinion can assist in achieving rational and fair trial outcomes. These medico-legal safeguards have the potential to prevent miscarriages of justice in criminal trials for infant homicide, irrespective of the type of homicide involved.

Better research and medical training would improve the accuracy and reliability of medical opinion evidence. If, as Popper argues, science is perpetually tentative, then a dogmatic stance that produces certainty by transforming subjective opinions into

objective realities should be avoided.[713] Any given medical opinion falls on a continuum of certainty, the extent of certainty being determined by the dimension being observed, with greater likelihood that measures of observable physical variables, such as skull fractures, will be relatively less subjective than psychosocial factors, such as parental relationship. Further, experts ought to be especially conscious that strong belief in a hypothesis (e.g. death was inflicted) does inevitably introduce its own form of certainty. Medical opinion that does not stray beyond the evidence can only enhance the reliability and accuracy of the derivative opinion.

Given judges' lack explicit scientific training, and changes to legal admissibility rules will take time, a prosecution ought to be avoided if there is significant disagreement between experts in controversial cases in which determination of the mechanism of death is based on uncorroborated medical or psychosocial evidence. The two ought not to be relied on to shore up or legitimise speculative opinion in the guise of science or authority.

Looking forward we must research the causes of SUDI with a strong focus on corroboration. Finding ways of accurately determining SUDI is urgently needed. Overarching changes in legal, medical and regulatory mechanisms are equally important in all jurisdictions. This includes ensuring professionals adhere to their codes of conduct, whether they are prosecutors or medical experts. Expert experience and confidence should no longer be accepted as a substitute for investigative rigour and accurate determination of the mechanism of death – death investigation lacks critical analysis and subjective beliefs have replaced opinions that are based on evidence. This is not a problem specific to a particular expert, jurisdiction or court. Wrongful convictions are preventable if all these approaches are adopted.

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[713] Ibid n 60.

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