
TECHNOLOGY INTEGRATION IN FORENSIC MEDICINE AND LEGAL EPISTEMOLOGY

Dr. Reshma Suresh, Assistant Professor, VIT School of Law, VIT University, Chennai

Mudunuru Kalyana Kartika Pallavi, LLM, VIT School of Law, VIT University, Chennai

ABSTRACT

Criminal justice system in India suffers inefficiency in providing accurate details required by the investigation and expert opinions to find the guilt and stealth of the accused or suspects which define the fate of the case. The traditional methodology followed to investigate a crime is subjective to the investigating authority and hence there is absence of objectivity to it. Human error had made their marks in the criminal justice system especially while pursuing investigation. Structural integration of technology in medical jurisprudence such as Virtopsy, sampling technologies in a medico-legal case in the criminal justice system and forensic medicine and toxicology in particular will bring objectivity to the investigation, specially, in the realm of forensic medicine and toxicology further aiding the success rate of the criminal justice system and demand re-interpretation of principles such as proof beyond all reasonable doubt, which usually create a penumbra of doubt. Especially when the weightage of evidential value given to expert evidence is just pebbles when compared to primary evidence such as eye witnesses but statistically most crimes take place in privacy. Even though technology has been integrated in forensic medicine and other investigative techniques, unless the weightage of evidential value given to expert evidence is equated to that of primary evidence, there is no objectivity to criminal justice system, the system suffers inefficiency and engulfs no possible advancement. The precedent set with such existing inconsistent weightage given to expert evidence has a domino effect on the succeeding cases, creating a chain reaction where these existing irregularities in the criminal justice system still breathe. Legal epistemology explores whether requirements of proof, like "beyond reasonable doubt" or "preponderance of evidence", are best construed as statistical probabilities, or as qualitative standards. Hence, forensic evidence is suggested to be given a status quo of primary evidence so it creates a fair ground for evidential testing in terms of veracity.

Keywords: Technology Integration, Virtopsy, Forensic Medicine, Post Mortem, Expert Evidence, Penumbra of Doubt, Domino Effect, Criminal Justice System.

OBJECTIVE AND SCOPE OF THE RESEARCH

The objective of the study is to arrive at the intricacy and proximities of the scope of technology integration in forensic medicine, further aiding the investigative agencies and interpretation of evidence law to incorporate objectivity to the research. The scope of the research extends to various areas such as medicine to understand the intricacy in clinical subjects such as anatomy, pathology, toxicology, pharmacology and medical ethics, science and technology to understand the rapid mutations in computer based applications on the medical research further influencing forensic medicine and investigation, jurisprudence and criminal law to understand the probability and viable options to test these dynamic advancements on the traditional principles in law to bring objectivity. The scope of this research would provide insights on the moment of singularity between law, medical jurisprudence and technology which would render re-interpretation and mutation of the traditional principles in evidence law and introduce dynamism thereto. The methodology adopted for the purpose of this research is doctrinal and non-doctrinal as per the requirement of the arguments put forth. Opinions of doctors dealing specifically with forensic pathology and toxicology to understand the current efficiency in following the traditional methodology of performing a medico-legal causal analysis shall be consulted.

LITERATURE REVIEW

The main objective of forensic medicine is to assess and determine the causal relationship between an action such as negligence or criminal act and the legal consequence i.e. an injury or death¹.

The author presents an interface that forensic medicine establishes a connectivity in the chain of transaction which is then perceived by the court. Medico-legal causal analysis needs to meet the evidentiary requirements by the court in terms of quality. Accuracy and the ability to explain the cause is the baseline requirement by the evidence law. However, the research lacks the relatability with Indian legal system due to differences in interpretation.

The forensic medicine primarily studies pathology, anatomy and toxicology. Forensic pathology is the study of types of death and their characteristics which is elaborated into

¹ P. Meilia, *Evidence-Based Practice in Forensic Medicine: From Inference to Performance* (Doctoral Study, Maastricht University 2022), <https://doi.org/10.26481/dis.20220124pm>.

different causes and methodologies of death². The literature lacks connectivity of all the forms and causative factors of death with the legal system and law which would have made the research complete.

1. INTRODUCTION: THE FORENSIC MEDICINE AND ROLE IN LEGAL SYSTEM

1.1 FORENSIC MEDICINE AND TOXICOLOGY AS A BRANCH OF FORENSIC SCIENCE

The word “forensic” has two meanings. One is solving a crime using scientific means while the other is the art of debating. The term originates from a Latin term named “forensus” which translates to “belongs to the forum” which further simplifies to “pertaining to court”. This essentially indicates that forensics is the scientific methodology used to solve a crime which will belong to the court.

Forensic science is a study of scientific subjects that are associated with legal reasoning. There are various branches of forensic sciences. Few of them are enumerated below to depict the depth of the subject.

Within the broad area of forensic science, there are many subspecialties, including pathology (the examination of body tissues and fluids), Toxicology (the study of poisons, including drugs), odontology (the study of teeth), psychiatry, anthropology (the study of human beings), biology, chemistry, and physics. The medical examiner may call upon forensic scientists who are specialists in these various fields for help in investigating a crime. For example, whenever it is suspected that drugs or poisons are involved in a crime, the medical examiner must obtain the services of a toxicologist.

One of the key areas in forensic sciences that aid investigation on a day-to-day basis is the forensic medicine. Forensic medicine is a branch of medicine that applies medical sciences to law terming the case as a “medico-legal” case.

Medico-Legal case

A medico-legal case in medical jurisprudence is a case where the medical diagnostics of the

² Bernard Knight et al., *Knight's Forensic Pathology* (3d ed. 2004).

subject is relative to the question of law. Consider, there is situation number 1 that is a woman is approaching the doctor for her tears in the vaginal canal due to high friction during sexual intercourse and situation number 2 where the woman is approaching the doctor for her injuries in her vaginal canal due to forced sexual intercourse. Here, the situation number 2 becomes the “medico-legal” case as the question of law here is “whether rape has been committed”. This is a realm where medicine and law interact at their odds. The criminal law jurisprudence is highly concentrated on evidence. Forensic medicine is an omnipresent entity that provides a scientific answer to an “assumption” against which the prosecution facts will be tested upon. Hence, medical ethics and code of conduct do integrate law with medical practice to keep the sanctity of the legal regime from the angle of medicine.

Forensic Medicine and its trajectory

1. Forensic Pathology

This field of study deals with the science of causative factor of death, time since death and the circumstances surrounding death. Forensic pathology shall not be confused with forensic medicine as forensic pathology only studies the dead while forensic medicine studies the dead and the alive.

Why is it important to understand forensic pathology is that the science of injuries and causative factor of death has to explain the allegations put forth by the prosecution in the court.

The dead body undergoes three major changes i.e. formation of rigor mortis which is the stiffening of muscles, algor mortis i.e. temperature of the body falls and livor mortis i.e. settling of blood in gravitational direction. These are important traits to calculate the time since death³.

For example, In Asphyxia there is absence of oxygen and pulsation which causes suffocation and thereby death. Hemorrhages cause internal bleeding usually in the brain which is the causative factor of death. The froth in the air passages, overinflation of lungs and the bulking of the skin due to osmosis suggests death due to immersion. Injuries such as laceration which are irregular tears, incisions which is a knife clean cut, abrasion which primarily due to friction, puncture wounds which are deep stabs with less diameter of wound suggest the weapon

³ Supra Note 2

used. These are important elements in forensic pathology that studies the mechanism of death and the process of death which is crucial in cases where an autopsy report has to be relied upon to determine the guilt of the accused.

2. Clinical Forensic Medicine

This field of study is a branch of medicine that studies and interprets the illnesses and injuries of the living subject. They associate themselves with medical examinations of the victims. The sub areas include gynecology, urology, orthopedics, pediatrics, radiology, anesthetics etc.

3. Forensic Toxicology

“It deals with the medical and legal aspects of the harmful effects of chemicals on human beings. It involves not only the identification and quantifying of a drug, poison or substance in human tissue, but also the ability to interpret the results of one’s findings”⁴. This field of study deals with variety of poisons and toxins which affect the human health. These poisons are categorized as corrosives, irritants, neurotics, cardiac and other miscellaneous toxins. Forensic toxicology plays a vital role in the cases pertaining to NDPS and other toxin infused crimes. They also help in anti-food adulteration system and vigilance.

1.2 PLACE FOR FORENSIC SCIENCE IN INDIA’S CRIMINAL JUSTICE SYSTEM

The role of forensic science in today’s world is very important to solve cases, to provide expert advice and to testify in courts so as to provide justice. The role of a forensic expert today is the backbone in the area of crime scene investigation and crime-solving as he attains the “missing links” of the case and that helps the courts to deliver justice. Forensic science according to medical jurisprudence is the application of science to law.

The ambit of forensic science is wide enough where one can determine the cause and effects easily.

Even though we have many specialized areas to aid investigation, we still lag behind. To illustrate that, consider the case of Selvi v. State of Karnataka⁵, where the usage of brain mapping and narco analysis of the accused was given the tagline “results in self-incrimination”.

⁴ Gautam Biswas, *Review of Forensic Medicine and Toxicology* (3d ed. 2015).

⁵ AIR 2010 SUPREME COURT 1974

This implies that the judiciary has had a bipolar approach when it comes to determining whether or not to integrate forensic sciences and appreciate their presence at the stage of investigation.

1.3 FORENSIC MEDICINE IN INVESTIGATION

In India, the role of forensic medicine is very critical as we have various procedures that mandate their presence. Say in a case where a dead victim is surfaced, an autopsy is mandatory and a medical examination in case of alive victim is done to trace material evidences.

Before getting into role of forensic medicine, let us understand the stages of investigation of a crime scene. Recognition i.e. scene survey, documentation and preservation of evidence, identification i.e. compassion testing, individualization i.e. evaluation and interpretation, reconstruction i.e. reporting and presentation. These stages in crime scene investigation can also be seen in rest of the investigation as well. The role of forensic medicine in investigation is primarily to provide an Autopsy i.e. a post mortem report.

Autopsy

There are two autopsies in medical jurisprudence i.e. a forensic autopsy and a clinical autopsy. The forensic autopsy is the medico-legal issue where cause of death is determined while the clinical autopsy is done when the person undergoing treatment dies, to find the causative factor to his death.

The autopsy has three stages namely the external examination, the internal examination and the closure.

The external examination: In this stage, the pathologist looks for any marks or wounds or bleeding externally and make note of it. This is crucial because in medicine “a wound showing up on the outside has a gravity of injury within” i.e. essentially that any wound outside that does not show on the inside is through a less force compared to a blunt force which causes the injury even inside the muscle tissue. The pathologist also collects material evidences on body such as fingerprint, blood marks, semen sample, dirt inside nails and hair clippings etc.

The internal examination: The pathologist first dissects the head to expose brain and its hypothalamus part and find any injuries or hemorrhages to see if death occurred through brain. Then the body is cut in a “V” shape to dissect further organs such as heart to find for any

myocardial infarction or deformity, the lungs to check if they have been suffocated or immersed in water and collect the small samples of these tissues which will be sent to the forensic science laboratory for further investigation.

The closure: Once the pathologist has collected the samples of tissue that he requires to send it to forensic science department, he later puts all organs inside and sews up the cut. The autopsy report is made which includes details about the subject, observation by the pathologist and the possible cause of death.

2. TECHNOLOGICAL INTERVENTION IN FORENSIC MEDICINE AND TOXICOLOGICAL DIAGNOSTICS

2.1 HISTORICAL EVOLUTION OF TECHNOLOGY RELATING TO FORENSIC MEDICINE

It is important to note that the technological advancements in forensic medicine are directly related to the technical advancements in general medicine and surgery. Hence, we need to look into the history of technical advancements in the realms of medicine and diagnostics.

Computed Tomography (CT) Scans (1970s): The development of CT scans in the 1970s was a major leap forward, offering cross-sectional images of the body with unprecedented clarity and detail,

revolutionizing the diagnosis of various conditions. In forensic medicine, the CT scans detect internal bleedings, tumors and clots, which are essential to determine the cause of damage in cases relating to assault.

Magnetic Resonance Imaging (MRI) (1980s): MRI technology, introduced in the 1980s, provided a new dimension to diagnostic imaging. Using magnetic fields and radio waves, MRI scans offer detailed images of soft tissues, enhancing diagnostics in neurology, orthopedics, and oncology. This advancement helps forensic medicine in studying the subject in microscopic level which integrates with other branches of forensic sciences.

Artificial Intelligence (AI) in Imaging: The integration of AI and machine learning in diagnostic imaging is setting the stage for unprecedented advancements. AI algorithms enhance image analysis, improve diagnostic accuracy, and predict patient outcomes, promising a new frontier

in personalized healthcare. AI is now integrating with forensic medicine at systematic level and in research and development.

2.2 CURRENT STATUS OF TECHNOLOGY INTEGRATION IN FORENSIC DIAGNOSTICS

Forensic pathology deals with the study that determines the time & cause of death that further aids the interpretation of “chronology of the transaction and manner of death”. It outlines the probability between “natural and unnatural death” that is crucial in criminal justice system; in case of unnatural deaths, it further determines the cause of such unnatural death using the data derived from the autopsy procedure i.e. types of injuries, whether or not it is post or ante-mortem to accurately find the only cause of death. Autopsy can be divided into two crucial procedures. Firstly, an external examination that notes the “on-sight condition of the body” and secondly, an internal examination that is done through dissection of the vital organs so as to conclude the possible cause of death.

A traditional autopsy is debated and the medical field is leaning towards a “virtual autopsy” i.e. a virtopsy. Presently, it is being demonstrated in AIIMS, Delhi. As of now, only a thousand or more virtopsies has been demonstrated and 35% of such findings actually required a traditional autopsy during the course of time. Virtopsy is a process that requires a CT and an MRI to work together to find the cause of death.

The virtopsies are more objective as they work on “data sets” and with high-end technology which reduces the chances of any pre-conceived notion in the mind of the pathologist.

*“Yes, it saves time and can be done from anywhere”*⁶ Dr. Vignesh S, a family physician pointed out when asked if virtopsies help in surpassing traditional course of autopsy.

Technology to solve leakage in the investigation

The technological advancements are implemented at a sectoral level. That is medical research and development are integrating more digital innovations in testing whereas the hospitals are integrating it in data sets and laboratories are using it in diagnostics. Hence there is no one channelized integration of technology in traditional forensic medicine and toxicology. This

⁶ Department of Family Medicine, KMK General Clinic, Hosur

sectoral integration will indirectly reduce leakages from the chain of custody and collection of evidences. Blockchain technology is now being discussed to integrate in crime scene investigation so the collected evidence's veracity is kept intact for reference even after years of procedure in trial and in appeal. This will help in case of circumstantial evidence that are perishable with time and are endangered to contamination.

2.3 THE EMPIRICAL DATA (ANNEXURE 1): DATA RESPONSE

The purpose of resorting to the medical practitioners in collection of data was derived from the fact that they are constantly exposed to the diagnostics such as a general physician who is also consulted during medical examination of the victim or accused would provide a firsthand information and expert opinion on whether or not technical advancements or algorithmic advancements actually provide strong assistance to the doctors who called as "expert witness" under section 45 of the Indian Evidence Act, 1872.

The experts consulted were from the Department of Family Medicine and Department of Cardiology out of which one is well exposed to general practice and diagnostics while the other is exposed to surgical mechanisms which would help us understanding the realm of forensic medicine from both surgical and generic angles. The technological advancements in both of these realms have been distinct while one is purely mechanical the other is algorithmic. Diagnostics somehow falls between these two ends where it is almost like gathering evidence for the subject patient, that would explain what he suffers from. These diagnostics are very conclusive, such as serology department confirms any irregularities in the fluids and lipids of the subject patient such as blood and semen which are key facts when it comes to crime scene investigation which only provides some serological samples; DNA fingerprinting department where the deoxyribonucleic acid structures and chromosomes are tested for their relevance to the subject, which is a key factor when it comes to crime scene investigation that leaves traces pertaining to DNA; Radiology department where CT scans, Cardiological diagnostics such as angiogram and other pictorial diagnostics take place, which is a key factor when it comes to medical examination of accused or victim especially is dependent as the damage to her body can determine between a grievous hurt and a battery. The seriousness of the crime is dependent on these factors when it comes to forensic medicine.

When the experts consulted were asked if they would resort to technological diagnostics initially instead of applying human skills in determination, one of the experts from department

of cardiology expressed that he would resort to technical diagnostics and then rely on it while the other expert from the department of family medicine stated that he would use his human skill to diagnose to whatever extent he can. The matter of diagnostics here in forensic medicine is important for the fact that the forensic autopsies done in India majorly depend on the human skill of the doctor to determine the cause of the death and the time since death, which are the key factors in cases pertaining to murder or other offences resulting in homicide. Dr Karthikeyan, Cardiologist had pointed out that technological intervention in forensic medicine or medical research in India had been sectoral and that not all hospitals or diagnostic centers are able to afford for it when asked if mechanical or algorithmic technology has been integrated structurally or sectoral. This implies that only private healthcare with capital and certain prime government healthcare institutions such as AIIMS New Delhi have incorporated algorithmic technology such as virtopsies in the realm of forensic pathology.

Virtopsies eliminate the chances of contamination at the autopsy theatre as the body would not be dissected. Which also inherently implies that the autopsy findings are “contamination-free” which would greatly reduce the chances of leakage in the chain of evidence. Generally, when traditional course of autopsy is taken, there are chances of the autopsy room hazard to contaminate the biological evidence which will be sampled and transferred to the forensic sciences laboratory which would cause irregularities between the findings of the Forensic Pathologist and the findings of the Forensic Serologist or Toxicologist and other fields of Forensic sciences. Throughout the interview with the expert medical practitioners, one strong conclusion can be drawn is that medical practitioners do have the temperament in appreciating the helping hand of technology or algorithmic interventions however they still take the responsibility of admission of veracity of such “expert opinion” given in court without actually pushing the blame on the technological error if any.

3 THE CASES WHERE FORENSIC SCIENCES WERE USED

3.1 FAMOUS CASES

There are many cases where forensic sciences were used. However, some of the notable cases are

1. The Nirbhaya Gang Rape case 2012: The DNA evidence extracted through blood, bite marks of the accused were present which confirmed the interaction between the accused and

the victim and rape. Forensic odontology had helped to size up the accused and the sex of the accused to further narrow down the guilt. This is a landmark case wherein the court had appreciated the role of forensic medicine to a point that the court arrived conclusively to the judgement that the accused were guilty beyond all reasonable doubt. However, these evidences were also backed by the dying declaration of the victim as well. This is also the instance where the court had stated that it welcomes non-verbal form of dying declarations as well, when the victim was in a state of no possibility of verbal communication apart from gestures and signs.

2. The Noida serial killing case, 2006: The famous Nithari cannibalism case where the forensic evidences were DNA which were thrashed by the court as they were all circumstantial but not conclusive.

The case revolves around the serial killing of children and women in sector 31 where suspected victims may have been counted till 19. The accused were Surender Koli and Monindher Singh Pandher who were accused of preying upon young children and women. They were killed, raped and then consumed by virtue of cannibalism by these accused, after which the leftover body parts were thrown into a sewer and other areas. As the smell of decomposition was unbearable, the severed and decomposed body parts were noticed by the locals which were then reported to the police. Initially Koli was sentenced to death, however, the Allahabad High Court had acquitted Koli on grounds of weak evidence, as the biological evidences collected i.e. the remaining body parts etc. Did not establish the guilt of the accused.

3. The Koodathayi Murders case 2016: The DNA evidences, the cyanide poisoning through a toxicological search has confirmed the deaths due to cyanide poisoning however the case is sub- judice. Hence, it is not a confident move to articulate this case more into the arguments put forth.

4. The Aarushi Talwar double murder case 2008: where the CBI suspected Aarushi's parents of killing Hemraj and Aarushi as they might have been caught in a compromising position. The CBI had two possible versions i.e. either the Talwar couple saw Aarushi and Hemraj in a compromising position and killed them in sheer fit of rage, or Hemraj tried to sexually assault Aarushi while being drunk and slit her throat as she would scream. But one notable question the CBI raised was that the door lock of Aarushi's room was openable from the inside and it required a key when opening from the outside. Aarushi's parents had the key, who else could open apart from her parents? Even if it was a sexual assault, how did the Talwar

couple sleep through the entire night without hearing Aarushi scream. The forensic evidences suggested murder and sexual interaction between Aarushi and Hemraj but were absent to convict the parents.

Crimes in India are too regionalized. Hence the forensic evidences are subjective and regionalized too.

3.2 CONTRIBUTION OF THESE CASES IN CRIMINAL JURISPRUDENCE

These cases are fascinating due to their cold nature.

Cold cases

A cold case is a crime investigator have not legally resolved. Solving crimes requires clear witnesses, suspects, and evidence; without these factors, cases can become cold. These cases can baffle police departments and thwart law enforcement agencies like the CBI. Investigations that go on for more than a year without resolution can have a disastrous effect on the family members of a victim in an unsolved murder, sexual assault, or missing persons case.

Cold case investigations significantly impact criminal jurisprudence by re-examining unsolved cases, potentially leading to new evidence, arrests, and convictions, and also by highlighting the importance of ongoing forensic science advancements and investigative techniques. However, they do not stand a chance at court as the evidences would have been perished already.

The question of criminal jurisprudence is not in the trial as there is a proper law thereafter, the question of criminal jurisprudence is while in the investigation.

The accused once gets acquitted due to failure in establishing his guilt, he cannot be tried again in the court but what about the case? The case file is left open on desks of the investigative department but they would not carry forward in finding the “new” accused and waste resources as they have already put the best of the forensic evidences before the court. Whether technology such as blockchain in restoring forensic evidences help? Is a question that courts have to answer.

4 LEGAL EPISTEMOLOGY: THE LAW AND THE LIE

4.1 INTRODUCTION TO LEGAL EPISTEMOLOGY

Legal epistemology explores whether requirements of proof, like "beyond reasonable doubt" or "preponderance of evidence", are best construed as credence's, statistical probabilities, or as qualitative standards. It enquires what, if anything, justifies these standards and how legal standards of proof ought to be responsive to practical considerations. Legal epistemology analyzes when and why evidence possesses a probative value; i.e., it explores how evidence makes a litigated claim more probable. It sheds light on what moral, political, economic, practical, epistemic justifications for excluding probative evidence. Legal epistemology is strongly interdisciplinary⁷. It is located at the crossroads of epistemology and law. To grasp this crossroads, one needs to draw upon psychology, forensic science, sociology, criminology, history, theology, politics, economics (especially behavioral economics), and statistics. It also involves the comprehension of many fields of philosophy: mainly philosophy of law and epistemology, including above all formal epistemology and social epistemology. For there to be a rule of law, for law to rule, there must be a determinant force⁸. This essentially indicates that there shall be no uncertainty in law. The author in their doctoral study indicate that a law and its force shall be content throughout its existence.

In our context, we can imply that the laws pertaining to criminal justice system shall be content and certain. However, this certainty is unfortunately not achievable due to subjectivity in it. Consider, the Code of Criminal Procedure, 1973 today repealed to Bharatiya Nagarik Suraksha Sanhita 2023. These procedural laws define investigation as "investigation "includes all the proceedings under this Code for the collection of evidence conducted by a police officer or by any person (other than a Magistrate) who is authorized by a Magistrate in this behalf⁹. The definition is all about authorization, but does not incorporate any indication towards objectivity. Objectivity in law ensures uniformity, subjectivity may only enable attention to the detail. Substantial laws like Indian Penal Code 1862 now repealed to Bharatiya Nyaya Sanhita 2023 are still interpreted objectively due to strict rule of Interpretation. However, the objectivity is absent in the procedural law, especially with the investigative agencies as they resort to their personal investigative techniques which makes them be selective in crime scene further missing out evidences.

⁷ Georgi Gardiner, *Legal Epistemology*, in *Oxford Bibliographies: Philosophy* (Duncan Pritchard ed., Oxford University Press 2019).

⁸ Amit Bindal, *Law, Myth and Modernity: A Study in Legal Epistemology* (2010).

⁹ Code of Criminal Procedure, 1973

4.2 PRESUMPTION OF INNOCENCE

"Item quilbet presumitur innocens nisi probetur nocens"

The principle of Presumption of Innocence is a hallmark of Criminal Jurisprudence in Common Law Countries. Its justification lies in the socio-legal consequences of convicting an individual for the commission of a crime. This principle acts as protection against erroneous convictions and ensures that an accused is not oppressed by the immense power and resources of the State. Lying at the heart of criminal law, this principle is invaluable for protecting an accused in criminal trial, which is a contest between two unequal actors namely the State and the accused. It protects his fundamental liberty and human dignity. Principles of burden of proof, which were vacillating till then were partly settled. It has settled rule of evidence that the burden of proving the guilt of accused is always on prosecution and only under exceptional situations, the rule can be relaxed¹⁰.

4.3 EQUATING THE EVIDENTIAL VALUE OF EXPERT EVIDENCE TO THAT OF PRIMARY EVIDENCE

Circumstantial evidence in Indian legal system is a type of indirect evidence which does not directly establish anything but the sequence of facts or events of the case itself are in a way that they become reasonable and sufficient enough to support the claim raised by any of the either party during the trial. That is, A piece of evidence that has a huge amount of evidence supporting it is usually regarded as circumstantial evidence. Even though it is not part of the action, it provides the court with the capability to make some assumptions or inferences that bring them very close to finding more facts that are directly associated with the timeline and transaction of the incident. It is also to be observed that every court, even the Supreme Court, has to take into consideration all the material circumstances before finding anyone guilty solely on the basis of circumstantial evidence; such circumstances have to clearly establish the guilt of the accused and should leave no ambiguity.

The procedural law

As per section 62, Primary evidence means the document itself produced for the inspection of

¹⁰ *Critical Analysis of Presumption of Innocence and Reverse Burden of Proof in India with Comparative Study* (Narayanrao Chavan Law College 2022).

the Court¹¹. Primary evidence is considered to be the highest evidence in India.

i) Eyewitness Testimony as Primary Evidence:

An eyewitness account is considered primary because it is a firsthand account of an event, directly observed by the witness.

ii) Direct Evidence:

Because it is firsthand, eyewitness testimony is also considered direct evidence, meaning it directly proves a fact in question or innocence of a person¹².

Under the Indian Evidence Act, 1872, expert evidence including forensic evidence is given the stand of secondary evidence even though they hold utmost objectivity. The veracity of evidence in India is tested through cross examination where the rival counsel calls upon the other counsel's witnesses and ask leading questions to check the credibility of the evidence. Not just primary evidence, all evidences go through the same procedure.

Even in Bharatiya Sakshya Adhinyam, 2023 as per section 39(1) "When the Court has to form an opinion upon a point of foreign law or of science or art, or any other field, or as to identity of handwriting or finger impressions, the opinions upon that point of persons specially skilled in such foreign law, science or art, or any other field, or in questions as to identity of handwriting or finger impressions are relevant facts and such persons are called experts"¹³. Essentially even the scientific temperament has been blindfolded with treatment of "third person" or secondary evidence. It is to question that Statistically, what percent of the trials have seen "eye-witnesses" or at least "direct evidence"? The idealist principles in criminal law doesn't define what is "proving beyond all reasonable doubt" and on top of that it's the "judge's subjective satisfaction" if the prosecution had proved beyond all reasonable doubt or not.

The most important stage of trial is the stage of cross examination as the evidence that withstands the questions in the cross examination is said to be "proved". This "proof" forms the transaction of "proving beyond all reasonable doubt". If every evidence stands the wrath of

¹¹ Indian Evidence Act, 1872

¹² Ankita Sureshkumar Patel, *Fidelity of Forensic Evidence in Criminal Trials in India* (doctoral thesis), <http://hdl.handle.net/10603/211347>. (timesofindia.indiatimes.com)

¹³ Bharatiya Sakshya Adhinyam, 2023

cross examination, it is said to be “proved” that the accused is guilty. Why is cross examination appreciated? It is because there is objectivity in the method of evaluating the credibility of evidence. However, our criminal justice system suffers inefficiency for this very reason.

Statistically, presence of eye witnesses to a crime are once in a blue moon as most of the crimes take place in privacy. In this scenario, the only objective evidence that is available is forensic evidence. However, these evidences are given the stand of “expert opinion” whereas for the pathologist “the body he got to perform autopsy was a primary source” to arrive at a conclusion. But since there is absence of eye witnesses or primary evidence, the weightage of evidential value to “expert opinion” here is below the standard, giving benefit of doubt to the accused. Benefit of doubt is a right for the accused but such benefit is given only after the evidences miserably fail to associate the guilt of the accused to the crime, not when the court does not take into account the full potential of the evidences put forth. Hence, if forensic evidences are given the status of primary evidence, the veracity of the prosecution allegations and facts can be rigorously tested against another primary evidence i.e. forensic evidence, ensuring burning will of the investigative agencies, prosecution, the defense counsel to collect and produce facts that prove their sides beyond all reasonable doubt.

Recent developments in the procedural law i.e. in the Bharatiya Nagarik Surakha Sanhita 2023, include mandatory forensic experts’ team to be taken to the crime scene and record the examination in a digital form. This step motivates the criminal justice system however, to what extent the motivation lasts, is a question for the judiciary and the investigative agency to answer.

Section 176(3) of BNSS, 2023 states “On receipt of every information relating to the commission of an offence which is made punishable for seven years or more, the officer in charge of a police station shall, from such date, as may be notified within a period of five years by the State Government in this regard, cause the forensics expert to visit the crimes scene to collect forensic evidence in the offence and also cause videography of the process on mobile phone or any other electronic device: Provided that where forensics facility is not available in respect of any such offence, the State Government shall, until the facility in respect of that matter is developed or made in the State, notify the utilization of such facility of any other State”. It is mandated that the forensic expert team articulate the crime scene, hence they’re not any “third persons” expert anymore but a part of the investigative agency itself. Hence, they qualify to be a part of “primary evidence”.

The Constitution

The core constitutional backing for evidence can be traced from Article 20 i.e. (1) No person shall be convicted of any offence except for violation of a law in force at the time of the commission of the Act charged as an offence, nor be subjected to a penalty greater than that which might have been inflicted under the law in force at the time of the commission of the offence.

(2) No person shall be prosecuted and punished for the same offence more than once.

(3) No person accused of any offence shall be compelled to be a witness against himself¹⁴.

Clause (3) is an immunity granted to any accused wherein he does not have to witness against himself. The supreme court in Selvi vs State of Karnataka, 2010 had clearly stated that brain mapping or nacre analysis is a clear violation of Article 20(3) and amounts to self-incrimination. This had casted a disregard for the forensic sciences and their credibility as the judiciary is still trying to look for “eyes” over “accuracy”.

However, in the Kolkata Rape-murder case of a PG Trainee Doctor, 2024 the sessions court had convicted the accused solely based on “circumstantial” i.e. “forensic evidence” stating that “forensic evidences” explained that fact in issue beyond all reasonable doubt, in the absence of the eye witnesses, which is most of the cases in India. This explains the subjectivity in criminal justice system of India.

“A trial is like a game of chess, only when two equal rivals fight, there is absolute veracity and credibility”.

5 PENUMBRA OF DOUBT AND DOMINO EFFECT

5.1 INTRODUCTION TO PENUMBRA OF DOUBT

"Penumbra of doubt" refers to a gray area or zone of uncertainty in law, where a legal rule's application is not clear or straightforward, leading to potential for different interpretations and outcomes. When a legal rule does not address a specific situation, it may create a penumbra of doubt about how the rule should be applied. HLA Hart in Hart-fuller debate argues that in

¹⁴ Constitution of India, 1950

certain circumstances a “penumbra of doubt” occurs whereby judges inevitably use their discretion in deciding cases. This is an indication towards realism pertaining in the legal system.

What is “doubt”? Is it the doubt raised by the prosecution? Is it the doubt in the judge’s mind or is it the doubt in interpretation of the words of the law? Is it the doubt in criminal jurisprudence? Is it the doubt and uncertain answer by the pathologist who is testifying? Is it the doubt by the investigative wing who has no answer for certain facts of the case? This is a question the criminal jurisprudence has to address, all together conjoin as the “penumbra of doubt”.

Why is penumbra of doubt an integral part to determine in legal system? We have two judges who operate at two realms of interpreting a law. They are positivists and then comes the idealists, the originalist and the dynamist.

Originalists focus on the words of the law and stick to the T’s and I’s of law whereas the dynamists take every situation surrounding the law into the bracket of “intent of law” as they believe that law should incorporate and operate according to the situation pertaining in the society.

Penumbra of doubt comes when the law has not addressed a specific situation and puts the trial in a place where the fate of the guilt is determined by the interpretation. For example, “victim was murdered with a knife” and the law says “anyone who kills with a knife is said to have commit murder”. The defense counsel questions “whether blunt knife is a part of the definition as the blunt knife is as good as a steel bar” and not a functioning knife. The fate of guilt is now dependent on the interpretation as the functions of a steel bar is different from a knife. This is a penumbra of doubt in this case.

This penumbra of doubt which is interpreted differently by various jurists causes uncertainty and irregularity, especially when originalist tries to move with each word of the law while others look for “morality and ethics in law”. These precedents further be at a rival state where one interpretation wants to take over the other.

5.2 PENUMBRA OF DOUBT IN CRIMINAL LAW

As seen, penumbra of doubt in law would create implications, similarly penumbra of doubt in criminal law would be fatal for the justice system. What is “doubt”? Is it the doubt raised by

the prosecution? Is it the doubt in the judge's mind or is it the doubt in interpretation of the words of the law? Is it the doubt in criminal jurisprudence? Is it the doubt and uncertain answer by the pathologist who is testifying? Is it the doubt by the investigative wing who has no answer for certain facts of the case? This is a question the criminal jurisprudence has to address, all together conjoin as the "penumbra of doubt". For a criminal trial, it is important to know facts from investigative wing, the clarity in judge's mind, the command in the words of law, the intricacy in criminal law jurisprudence, the extensive mind of the testifying pathologist with probability and the interlinked establishment of facts by the prosecution. Consider them as the pillars where one shakes and the rest suffers too.

Especially when there are doctrines such as proving beyond all reasonable doubt and innocent until proven guilty are operating from a higher dimension of the criminal law. Because benefit of doubt primarily is given to the accused and law never punishes someone "almost guilty" too. Imagine the judgement says "the accused is guilty due to 70% probability of the guilt"¹⁵. 30% is the penumbra of doubt that was never answered, if it was, then there should be no reason why the percent bar was not raised to 100%. So, should we incorporate penumbra of doubt in the criminal justice system and start looking for probability ratios or stay with the ideal template of "proof beyond all reasonable doubt"? And if we bring the probabilities, who would assist us in ascertaining the probability? The witness or the counsels? Obviously, the witnesses. But we again would face another war between subjectivity and objectivity. Not all witnesses answer milk and water separately. Consider in a rape case 3 witnesses are called, a bystander, a pathologist and an eye witness. The bystander says "I've seen the accused go inside the room and lock doors and hence he raped her". The eye witness says "the accused had got into compromising position before the victim could even speak and raped her". The pathologist says "there are no semen samples, no friction tears essentially no sexual intercourse happened but only marks of body weight of around 70 Kgs as he weighs significantly more than the victim, but presence of hard hand prints on body as the victim was held tighter". Here, the bystander has seen the accused enter the room but reached at conclusion that he raped the victim only because the accused closed the room, the eye witness said the accused overpowered the victim by getting into a compromising position but the eye witness failed to say whether or not there was any attempt to "prepare the victim" for rape. The pathologist confirmed that there was no sexual intercourse but just holding the victim tight and the marks due to the heavy weight on

¹⁵ *Convicting With Reasonable Doubt*, 93 Notre Dame L. Rev. 757 (2018).

her. In this case, we essentially see that pure objectivity was there in the testimony of the pathologist than the eye witness as he was very focused on the fact that the accused overpowered the victim by putting himself onto her but he missed to focus whether or not actual rape has been committed or at least “prepared”, hence there is a presence of objectivity with a subjective conclusion. The bystander’s testimony was purely subjective as he presumed rape would have been committed because the accused locked the doors. So, bringing probability into conviction is not justifying the purpose either. The only option to bring objectivity is that to give evidential weightage to forensic expert evidence.

5.3 DOMINO EFFECT ON CASES IF THE REVISED EVIDENTIAL VALUE OF THE EXPERT EVIDENCE WAS INDOCTRINATED

In law, the "domino effect" refers to a chain reaction where one legal issue or decision triggers a series of related problems or consequences, often leading to a cascade of negative outcomes. Consider the cases cited above. The Nithari serial killings case, the Aarushi Talwar case, The Jolly Joseph (koodathayi murders) case. All of these cases have seen a benefit as there is doubt. Since most of the evidences are circumstantial, the court is hesitant to construe them in the process of conviction. The court acquits the accused merely because “the light switch was not on” while the murder was committed and as per the statements of the witness “light switch was on”. Role for Expert evidence in India is as good as “circumstantial evidence”. Generally, expert evidence is seen as a part of secondary evidence unless the court requires to treat it different from other secondary evidences whereas the witnesses with ears and eyes are given the status of primary evidence. This power shift undermines the veracity of the other evidences. Consider these judgements are given, they will be cited in further cases precedents creating a domino effect. Hence the inconsistency is cited and passed down through generations of cases in form of precedents. Understandable that this statement is a long jump on the mechanism of the criminal justice system but statistically, what is the conviction rate in India and what is he rate of acquittal just because there is absence of primary witness?

The domino effect of equating the evidential weightage to that of primary evidence would provide equal footing for the rivalries i.e. the facts of the prosecution is tested against the forensic evidence in form of expert evidence. Testing of veracity is most efficient when two equal nodes are kept against each other. Preference of one over the other in terms of weightage would create an imbalance in the evidential weightage when clearly the objectivity in evidence

is most present in forensic evidences and thus the conviction. Hence the cases citing these judgements would have a considerable credibility creating a strong backing of precedents.

6 CONCLUSION

6.1 SUMMARY OF FINDINGS AND RECOMMENDATIONS

Throughout the research, it has been found that criminal justice system today suffers uncertainty at various levels. Say it at investigative level or at trial or at evidence level. The criminal justice system advocates for objectivity in investigation, but sadly, they are the most subjective ones. The investigative agencies are trained to give subjective approach to the crime scene investigation as they're taught words such as "every crime is unique" whereas the they're completely forgotten to give the ultimate object of the investigation, i.e. to objectively solve the case while being subjective in drawing the mind planning for the course of investigation.

There is systematic and sectoral integration of technology in forensic medicine. That is through research and development where the medical research laboratories are able to afford for buying algorithmic inventions from technological companies and further bring efficient mechanical and algorithmic diagnostic systems that aid medical regime including forensic medicine. These technological advancements include artificial intelligence, blockchain and other software's used apart from virtopsy and diagnostic machineries. However, it is also important that the weightage of evidential value given to the expert evidence in terms of forensic sciences shall also be equated to that of primary evidence and demand the re-interpretation of "proving beyond all reasonable doubt" to attain the objectivity in finding the guilt of the accused.

It is also to recommend that objectivity into criminal justice system may be a bitter taste for the "idealists" and "perfectionists" who advocate of uniqueness in each crime however, statistically taking the intricate details of the mechanism we have seen these many years in terms of investigation, it is important that now we change out stand from subjectivity to objectivity in terms of investigation. Since, the raw hands and eyes are not efficient and foolproof compared to a better

survival of veracity of technology due to their mathematical nature, there exists less or no chance that results in contamination of evidences. Technological interventions in forensic medicine such as virtopsies shall be implemented throughout India so that there is uniformity

in conducting criminal trials in India, investigative techniques in India and there is further full scope of performing a second autopsy on the subject through a traditional way of conducting an autopsy if the court has any doubt. This way, not only we integrate the objectivity into the investigation, we also test it against human skills whenever necessary. This also preserves the dignity of the dead and morality to not to bother the dead once the traditional autopsy is performed. Subjecting them again to another autopsy might be a question on the dead's dignity. Hence, virtopsies ensure the dignity of the dead as well.

6.2 FINAL WORDS

Somewhere, we need to understand that there is significant power imbalance, i.e. inherently the prosecution side is much more powerful in terms of all state machineries working for them and the effective collection of facts favoring the victim is present. However, what about the opportunity to the Accused? Don't we need an objectivity in investigation? Understandable that the accused is given the benefit of doubt but the power imbalance does not justify the benefit of doubt as there is no equal effort from the side of state machineries to find relevant facts that explain the innocence of the accused as well. Only when two equals are kept to tackle, there is a justifiable proof of "guilt". Hence, do we need to re-consider the interpretation of what is "proving beyond all reasonable doubt"?

ANNEXURE 1: QUESTIONNAIRE AND RESPONSES BY THE MEDICAL PRACTITIONERS

RESPONSE NO.1

TECHNOLOGY INTEGRATION IN FORENSIC MEDICINE AND LEGAL EPISTEMOLOGY

DESCRIPTION AND PURPOSE OF THE STUDY:

Good day, this is Kartika Pallavi, a law student of Vellore Institute of Technology in Chennai currently working on my dissertation study named "Technology integration in forensic medicine and legal epistemology" which focuses on the importance and impact of technological advancement in medical research, thereby affecting the development of forensic medicine. It is well established that the role of forensic medicine in criminal justice system is symbiotic and that any development in forensic medicine or medical research has a direct effect on the

evidential veracity in the due course of criminal trial outcomes. Hence, the purpose of this research was to advocate for technological intervention in the realm of forensic medicine and medical research and further appreciate their accuracy in evidence. The purpose of this survey is to derive expert opinion from medical practitioners to understand their temperament towards technological intervention such as artificial intelligence or other algorithmic inventions in medical practice and further implicate their opinion in support of the arguments put forth in the study.

INSTRUCTIONS:

- a) You are required to select the option that mostly explains your temperament towards the proposition put forth by the virtue of questions.
- b) The options for the questions would be reflected in terms of (a / b / c). Kindly choose it through a tick mark typed against the option by editing this word document.
- c) Once the options have been selected and that the survey has been filled, save the document and send the edited document back to the person who shares this survey pool to you.
- d) You might be asked an opinion in the end of the survey as an open-ended question for you to express your opinion on the recent advancements. You have the discretion to explain what you feel about the inefficiency that is pertaining in medical research or medical practices in terms of technology.

QUESTION POOL:

1. Name and Designation: Dr. N. Karthikeyan
2. Department: Cardiology
3. Hospital address: Dr. Muthu's Hospital, Coimbatore
4. Email ID: N/A
5. Give an overview of what areas you've specialized or have experience throughout your practice.

(your areas of specialization):

Response: Cardiology and General Practice

6. Consider a person approaches you with certain health issue, how do you diagnose the person?

(Choose an option from below a/b/c):

- a) Do you make an assumption that the person is healthy and then look for factors that prove your assumption otherwise?
- b) Do you make an assumption that the person is unhealthy through the series of information the person gives you and then try finding factors that proves your diagnosis right?
- c) Refer some testing and then ascertain the diagnosis by relying on the laboratory results.

7. Did you notice technology being integrated in diagnostics and what is your opinion?

(Choose an option from below a/b/c):

- a) Yes, it is a structural integration in different fields of medicine and I feel supported by it.
- b) No, it has not been fully integrated in different fields of medicine and I feel it would just compliment the skillset of doctors.
- c) Yes, however it is a sectoral integration and I feel only certain sectors in healthcare regime can afford to integrate technology with the existing service.

8. Do you consider that technology such as artificial intelligence is more accurate with results than the medical practitioners in diagnostics? *(Choose an option from below a/b):*

a) Yes

b) No

9. Consider, you examined a patient for injuries in a medico-legal case and found blunt force injury. This examination is assisted by a technology that scans the injury and provides what type of an injury it is. The usage of that technology is inevitable because of the structural

integration in the medical research and development. You are required to provide testify in the court as an “expert” regarding the injury. The following are two options to testify. Which approach would you choose. *(Choose from below option a/b):*

- a) Testify that you’ve relied on the new technology that scans the injury and provides the causative factor of the injury.
- b) Testify that the you’ve taken assistance from the new technology while not compromising on the human skill to arrive at the conclusion regarding the injury.

OPEN ENDED QUESTION:

10. Are you familiar with the concept of virtopsies? Do you appreciate the integration of virtopsy instead of traditional method of conducting autopsies (whether clinical or forensic)? If yes, why? If no, why?

Response: Not Familiar with it however I encourage to use it.

RESPONSE 2:

TECHNOLOGY INTEGRATION IN FORENSIC MEDICINE AND LEGAL EPISTEMOLOGY

DESCRIPTION AND PURPOSE OF THE STUDY:

Good day, this is Kartika Pallavi, law student of Vellore Institute of Technology in Chennai currently working on my dissertation study named “Technology integration in forensic medicine and legal epistemology” which focuses on the importance and impact of technological advancement in medical research, thereby affecting the development of forensic medicine. It is well established that the role of forensic medicine in criminal justice system is symbiotic and that any development in forensic medicine or medical research has a direct effect on the evidential veracity in the due course of criminal trial outcomes. Hence, the purpose of this research was to advocate for technological intervention in the realm of forensic medicine and medical research and further appreciate their accuracy in evidence. The purpose of this survey is to derive expert opinion from medical practitioners to understand their temperament towards technological intervention such as artificial intelligence or other algorithmic inventions in

medical practice and further implicate their opinion in support of the arguments put forth in the study.

INSTRUCTIONS:

- a) You are required to select the option that mostly explains your temperament towards the proposition put forth by the virtue of questions.
- b) The options for the questions would be reflected in terms of (a / b / c). Kindly choose it through a tick mark typed against the option by editing this word document.
- c) Once the options have been selected and that the survey has been filled, save the document and send the edited document back to the person who shares this survey pool to you.
- d) You might be asked an opinion in the end of the survey as an open-ended question for you to express your opinion on the recent advancements. You have the discretion to explain what you feel about the inefficiency that is pertaining in medical research or medical practices in terms of technology.

QUESTION POOL:

1. Name and Designation: Dr. Vignesh S
2. Department: Family Physician
3. Hospital address: KMK General Clinic, Hosur
4. Email ID: ritetovignesh@gmail.com
5. Give an overview of what areas you've specialized or have experience throughout your practice.

(your areas of specialization):

Response: Family Medicine

6. Consider a person approaches you with certain health issue, how do you diagnose the person?

(Choose an option from below a/b/c):

- a) Do you make an assumption that the person is healthy and then look for factors that prove your assumption otherwise?
- b) Do you make an assumption that the person is unhealthy through the series of information the person gives you and then try finding factors that proves your diagnosis right?
- c) Refer some testing and then ascertain the diagnosis by relying on the laboratory results.

7. Did you notice technology being integrated in diagnostics and what is your opinion?

(Choose an option from below a/b/c):

- a) Yes, it is a structural integration in different fields of medicine and I feel supported by it.
- b) No, it has not been fully integrated in different fields of medicine and I feel it would just compliment the skillset of doctors.
- c) Yes, however it is a sectoral integration and I feel only certain sectors in healthcare regime can afford to integrate technology with the existing service.

8. Do you consider that technology such as artificial intelligence is more accurate with results than the medical practitioners in diagnostics? (Choose an option from below a/b):

- a) Yes
- b) No

9. Consider, you examined a patient for injuries in a medico-legal case and found blunt force injury. This examination is assisted by a technology that scans the injury and provides what type of an injury it is. The usage of that technology is inevitable because of the structural integration in the medical research and development. You are required to provide testify in the court as an “expert” regarding the injury. The following are two options to testify. Which approach would you choose. (Choose from below option a/b):

- a) Testify that you've relied on the new technology that scans the injury and provides the causative factor of the injury.
- b) Testify that the you've taken assistance from the new technology while not compromising on the human skill to arrive at the conclusion regarding the injury.

OPEN ENDED QUESTION:

10. Are you familiar with the concept of virtopsies? Do you appreciate the integration of virtopsy instead of traditional method of conducting autopsies (whether clinical or forensic)? If yes, why? If no, why?

Response: Yes, it saves time and can be done from anywhere.

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