

## REVIEW ARTICLE

## A New Model of Integrated Forensic Database in India- Road to Future

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### Abstract :

There have been tremendous technological developments in the 20<sup>th</sup> century which has been called the age of science. Forensic science in India also developed in the 20<sup>th</sup> century and intensified in the 21<sup>st</sup> century. For timely solving crime cases through proper scientific investigations, a lot of facilities were created in India. But due to the increasing number of crime cases, efforts are being made, but still, it is not enough. There is a further need for improving Forensic Science in India. In countries like the Philippines and Switzerland, an integrated database of these systems has been formulated and implemented to deal with sexual offense cases and sample evidence like DNA and its dealings. This article highlights and discusses the integration of intelligence units of Police, Forensic Experts, and Forensic Medicine Doctors sharing a common database which is linked first in the state and then nationwide, an integrated DNA model which is needed to increase the success rate in sexual assault cases, problems, a roadmap for better future of forensics in India. A feasible model, keeping in mind the Indian scenario and administrative context, has been depicted in detail.

**Keywords :** Forensic science; Forensic database; Forensic medicine; Evidence; DNA isolation.

### Introduction :

Over the last few decades Forensic Science, Forensic Medicine, and Toxicology have advanced significantly worldwide.<sup>1</sup> Police, Forensic Scientists and Forensic Medicine doctors are interconnected with each other professionally in dealing with criminal cases. Crimes are committed anytime at any place and in any form.<sup>2</sup> Proper analysis of evidence can make it easier to identify the guilty and innocent. Particularly in cases of brutal and organized crimes, forensic scientific evidence plays an important role.<sup>3</sup>

Presently in India, there are various Forensic Science Laboratories in the Government and private sectors. Central Forensic Science Laboratory (CFSL), State Forensic Science Laboratory (SFSL), and Regional Forensic Science Laboratory (RFSL) are the government laboratories whereas Sherlock Institute of Forensic Science (SIFS), Clue 4 Evidence are some of the private laboratories. Forensic evidence analysis affects the victim or accused's life significantly- from criminal trials or civil trials, conviction or acquittal, loss of job, career, health, and what not.<sup>4,6</sup> Disbursement of justice and forensic procedures mainly depend on the quality and quantity of the sample evidence and the performance and dealing of the first responding officer who visited the crime scene.<sup>3</sup> Crime scenes and possible evidences are

often tampered and disturbed due to mishandling. Basically, the evidence should be collected by a trained forensic science expert with his best skill and knowledge. To maintain the proper quality of evidences one should follow 7S of Crime Scene Investigation i.e Securing the scene, Separating the witnesses, Scanning the scene, Seeing the scene, Sketching the scene, Searching for evidence, Securing and collecting evidences.<sup>7</sup> After that Packaging, Marking and Labelling should be done to maintain the proper chain of custody from the crime scene to the court of law.

To maintain the quality of testing an integrated system and intelligent databases are much more important thing. In our country it is not yet well utilized. The conviction rate in India is quite low (around 50% currently) in comparison to Canada (62%), Israel (93%), UK (80%) and US (90%). To improve the situation, an integration of forensic information and criminal intelligence database is very important.

**Existing database integration systems worldwide:** In most cases, the insufficient sample of DNA makes the situation challenging. The samples either degrade or are contaminated due to improper storage. So, while dealing with the medicolegal evidence, for maintaining a proper chain of custody a workflow of DNA model has also been formulated and started recently in the Philippines which maximizes the quality analysis of the collected sample evidence. DNA is a vital key that unlocks all the possible clues. The criminal justice system is improved to a significant extent in the Philippines by these developments. This workflow of the DNA model changes the overall system and identifies the actual perpetrator of the crime.<sup>8</sup>

Another integrated system has been implemented in Western

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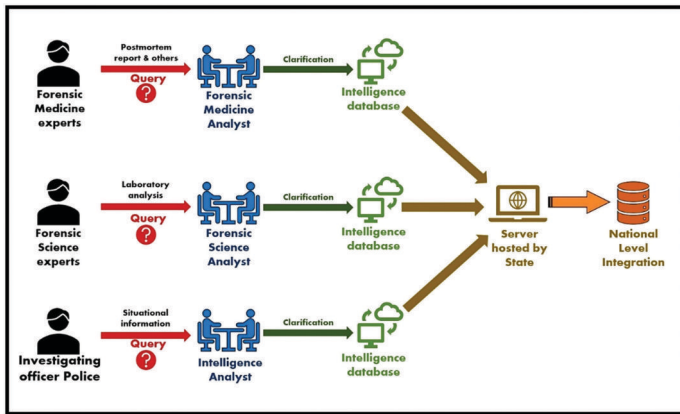
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**Figure 1.** The proposed model interlinks Police, Forensic Experts & Forensic Doctors database automatically and feeds the shared intelligence database through a secured VPN connection. The sever is hosted by State Police, FSL Experts & Forensic Doctors and ultimately merges at national level.

Switzerland to deal with the high volume of crimes. The proposed model there interlinks Police, Forensic Experts' & Forensic Doctors' information databases automatically and feeds the shared intelligence database through a secured VPN connection. The server is hosted by State Police, FSL Experts & Forensic Doctors and ultimately merges at the national level. It has already started to build databases of each and every crime. The databases include possible opinions and explanations of the modus operandi, DNA, Shoe and Ear Marks, Images, Fingerprints, and other evidences. This integrated system is very much helpful for solving the crimes there. The same person who previously committed a crime is easily detected. It is linked to the crime scene, criminal, and modus operandi of the criminals.<sup>9</sup>

**Problems in dealing criminal cases in India:** There are several pitfalls and shortcomings, when we looked into the Indian Forensic scenario carefully.<sup>10</sup> Most of the officers of Police are not trained properly and due to lack of knowledge they contaminate the evidences. It is also the most alarming issues of Forensic Science. The main factors are lack of research and development, lack of experts, lack of instruments and chemicals, not maintain proper protocols.<sup>11</sup> There are very low number of employees working in laboratories and they are not much knowledgeable in forensic.

The adversarial legal system of India gives an equal chance to both prosecution and defense and clarifies it later. After performing the test of preserved evidence, the prosecution experts verify testimonials and give their expert opinion. The defense party can anytime challenge the expert opinion. The second expert's opinion can also face the same problem. The scientific data and evidence should not be hampered by the adversarial legal system.

**The Proposed Model in India (Fig-1):**<sup>9</sup> There are large number of pending cases in each Forensic Science Laboratories so we have to develop the system. To develop Forensic Science, a similar model [Fig-1] can be proposed and implemented in India. The Forensic Expert can explore only when the model implemented first in states, then in nationwide.<sup>1</sup> After developing and implementing the model, the rate of pending cases becomes

less and within few years it becomes zero.

**A proposed Integrated System of DNA Testing Model in India (Fig-2):**<sup>8</sup> DNA testing consists of a number of steps and it is time consuming process. So, an integrated system of DNA Model is prepared (Fig 2) to maintain the proper chain of custody without any contamination of the collected evidences. If this system is implemented in India, it would be helpful for the Forensic Experts to solve the cases in a systematic way.

**Evidence Collection, Storage and Characterization:**<sup>8</sup> The first responding officer of Police i.e. the Investigating Officer of the case (I.O.) and the Forensic Expert with his team should go and protect the crime scene. If the victim is still alive, send him to the hospital and if not send the body for post-mortem examination. After that searching should be done for possible evidences without any delay. The evidences are packed and sealed in paper packets or container and sent to Forensic Science Laboratory for analysis. If the accused person or perpetrator of the crime is identified and found, he along with the victim or deceased are examined by Forensic Medicine experts (Doctors) for possible evidences and then sent to the Forensic Science Laboratory accordingly.

In laboratory, the samples are to be carefully examined. If the materials are visible, presumptive tests are performed. If it is not visible in naked eye examination, alternative light sources are to be used for identification of the materials at first. Then presumptive tests are performed. In sexual assault cases the samples are basically vaginal, anal and urethral swabs and smears. The samples are stored at room temperature, but samples mixed with feces are stored at 4°C. sometimes condom may be found from crime scene. If the external and internal swabs are available, Semenogelin (Sg) test is performed. If the samples are mixed with blood, Acid Phosphatase test is to be performed. If the test is positive, Semenogelin (Sg) test is performed and if negative then presence of other materials is tested.

**DNA Extraction, Amplification and Fragment Analysis:**<sup>8</sup> The samples are then sent for DNA analysis. There are three methods of DNA extraction: i) Organic method, ii) Inorganic method and iii) Kit method. After that quantitative Reverse Transcriptase-Polymerase Chain Reaction (RT-PCR) amplification is done which measures the amount of male DNA present in the sample. Specific primers are used during RT-PCR that attach a fluorescent tag to the copies STR. The size of Short Tandem Repeat (STR) at each genetic locus is determined using genetic analyser. The genetic analyser separates the copied DNA by Capillary Gel Electrophoresis (CE) and detect the fluorescent dye on each STR. The fragments can be detected while we put the raw data into a computer.

**DNA Data and Evidence Interpretation:**<sup>8</sup> Running the sample through CE generates electropherogram through which allelic peaks can be measured. The number of times a nucleotide sequence is repeated in each STR can be calculated from size of the STRs. A Forensic Scientist can use this information to determine if a body fluid sample comes from a particular person. The two DNA profiles from different samples are then compared and if found same, the chance that the samples came from

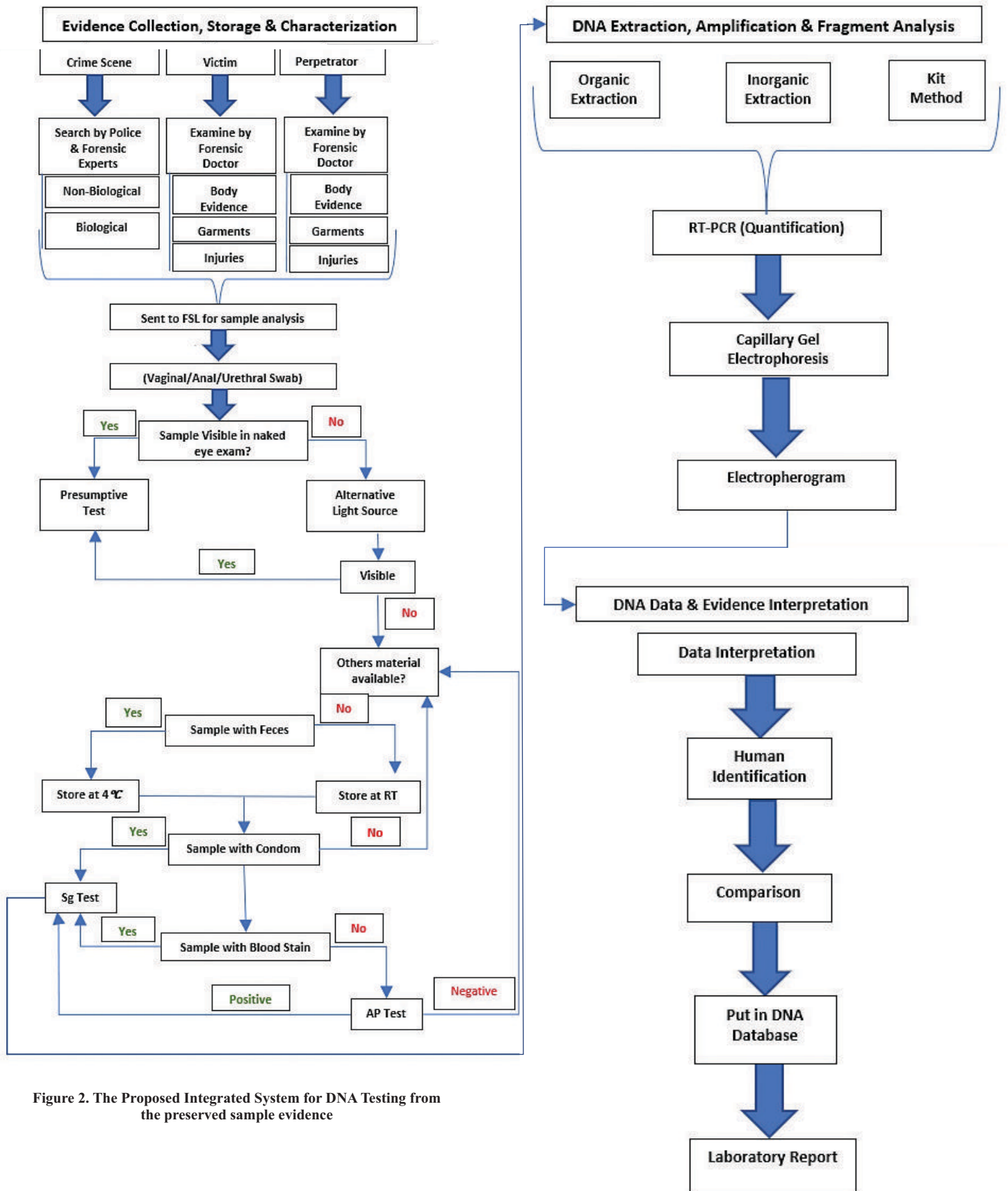


Figure 2. The Proposed Integrated System for DNA Testing from the preserved sample evidence

different persons is low. This provides strong evidence that the sample have a common source. After that put it into DNA database for future use. Lastly, a laboratory report on analysis of the sample materials must be prepared.

#### Roadmap for better future:<sup>12-15</sup>

1. The scene of crime is to be properly secured.
2. The crime case exhibits are to be collected without contamination, duly preserved, packed, labelled, signed, sealed & forwarded scientifically maintaining the chain of custody.
3. Physical evidences such as photographic and videographic recording from the scene of crime are compared with the databases for identifying the criminals.
4. Proper examination of the evidences should be done without any delay to facilitate the investigation process.
5. Assistance in the inquiry procedure of Ld. Courts and other commissions are to be readily sought.
6. Development of an online integrated platform for video conferencing can shorten the unnecessary delay.
7. For detail Forensic examination, individual database is to be prepared for fingerprints, footprints, firearms, DNA, tyre marks, biometrics, NDPS, wildlife exhibits, hair, currency notes, coins, passports, and other relevant documents.
8. Research and development of various technology in the modern branches of forensic science is need of the hour.
9. Development of Forensic Science education is to be updated and regularised.
10. Police, forensic science students and laboratory experts are to be trained professionally regarding dealing with sample evidences, maintaining the chain of custody and examination of the preserved samples.
11. Recruitment of more employees in forensic science laboratory for prompt and better service.
12. The forensic science laboratories in India need modern technology and ISO certified instruments for better testing of the samples.

#### Conclusion:

The integrated management of the database of forensic evidence utilized in criminal cases for identifying the pattern and series of crime is underestimated globally. It is the pillar of legal dealings which has a crucial impact on the disbursement of justice. This field's recent advances in forensics can be explored only after the implementation of integrated forensic database management systems across the state and the nation. Moreover, the integration of forensic case data can supplement information on the structure of criminality and give more insight into operational and strategic decisions. The State Government and Central Government must give immediate attention to this issue to improve the medicolegal investigation and conviction rate for which more allocation of funds to build up the system is necessary.

**Conflict of interest:** None declared.

**Acknowledgment:** None

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