

# The Investigation of the Causes and Manner of Infant Mortality in Forensic Casework

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**Abstract:** The infant mortality is the death of a child less than one year of age. Its investigation begins with the circumstances of the discovery history of infant such as medical status, prenatal, delivery and postnatal information which allows the Forensic scientists to focus the investigation. It is based on data from the police and judicial system, data from infant's parents and relatives, and neighbors through interviews and forensic DNA analysis. All physical evidences found at the crime scene must be safeguarded by a chain of custody to ensure proper processing. The final reports is reported either accidental, homicide, suicide or undetermined death. The scientific evidence of infant mortality admissible according to the scientific techniques generally accepted as reliable in the scientific community. The expert's conclusion should be exposed through cross-examination. This paper assess the cause and manner of infant mortalities. It also describe the scientific techniques used in investigation of such cases.

**Keywords:** Autopsy, Crime scene, Casework, DNA dragnet, infant, physical evidence.

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## 1. INTRODUCTION

The infant mortality is the death of a child less than one year of age. It is composed of neonatal and postneonatal deaths. The infant mortality rate is an indicator that is calculated by dividing the number of infants who died before their first birthday by the number of live births in a given year. It is indicator for assessing the maternal and child health status of a country and for calculating life expectancy at birth (Singh *et al.*, 2010).

The highest infant mortality rate can be found in Sub-Sahara Africa (75 infant deaths per 1000 live births) while lower rates are found in developed countries like Europe (11 infant deaths per 1000 live births) (Reidpath, 2003). It is not always readily apparent that the infant's deaths are the result of homicide or child abuse.

The main causes of infant mortality are Sudden infant death syndrome, prematurity, birth defects, respiratory distress syndrome, maternal complications during pregnancy, short gestation or low birthweight, homicide, diseases, accidents and unintentional injuries (MacDorman *et al.*, 2008).

Understanding the risk factors of infant mortality or infant mortality rate and how they vary from a country to another, is an essential tool for policymaker by forensic investigators. The Stillbirth is the death of a baby before or during birth after 24 weeks. The Perinatal mortality are stillbirths plus early neonatal deaths under 7 days. The stillbirth rate is the number of stillbirths per thousand total births. Low birth weight are the weight at birth under 2500 g. Worldwide, 3.1 million newborns still die each year and most of these deaths are preventable (Lawn *et al.* 2012).

According to the centers for disease control and prevention, about 25,000 infants die each year in the United States. The United States' infant mortality rate (US IMR) is higher than the rates found in many western European and east Asian countries (Heisler , 2012). Without a dramatic change in the trajectory for Africa it is estimated that, it will take over 150

years for an African newborn to have the same chance of survival as one born in Europe or North America (Oestergaard *et al.* 2011).

## 2. CASE STUDY

The political issues, cultural, poverty, unwanted pregnancy, hereditary diseases, the mother's level of education, environmental conditions, malnutrition, medical carelessness, mental illness social problems and substance abuse are the most common cause of infant mortality nowadays around the world. Not only, in the past the act of killing infants was a widespread practice in many society by different cultures around the world. Nowadays, it is considered to be a crime; however, it is still performed. In some cultures, children are not considered to be human beings until certain ceremonies have been performed and killing of infants before those ceremonies is not considered as a homicide, the male offspring has more values than female, etc.

Some societies ban infanticide almost completely while others permit it in certain cases. At various times some of these cases have been allowed in some societies like infanticide for the sake of the mother's health including her mental health. Infanticide where a pregnancy is the result of a crime such as crimes like rape, incest or child abuse.

Infanticide where the child has an unacceptable quality of life such as cases where the child has serious physical handicaps, serious genetic problems and serious mental defects. Infanticide for social reasons including poverty, mother unable to cope with a child (or another child), mother being too young to cope with a child.

According to report of world health organization, the risk of a child dying before completing the first year of age was highest in the WHO African region (60 per 1000 live births) about five times higher than that in the WHO European region (11 per 1000 live births). Globally, the infant mortality rate has decreased from an estimated rate of 63 deaths per 1000 live births in 1990 to 34 deaths per 1000 live births in 2013. Annual infant deaths have declined from 8.9 million in 1990 to 4.6 million in 2013 (WHO, 2014). Infant mortality especially infanticide is difficult to report, because in most cases these deaths are covered as stillbirths or children are not registered at the civil registry after the birth. In this cases scientific technologies are taking place through investigation and forensic DNA analysis.

## 3. THE CAUSES OF INFANT MORTALITY

### Infanticide:

The infanticide is a significant contributor to infant mortality. It is the intentional killing of children under the age of 12 months. The main cause of Infanticide is child abuse and gender selection. In some countries female infanticide is more commonly than the killing of male offspring due to sex selective infanticide or honor killing (Overpeck *et al.*, 1998). They are two types of infanticide: direct infanticide and indirect infanticide. The direct infanticide is killing the baby deliberately by means of dehydration or starvation, suffocation or head injuries, etc. The indirect infanticide begins with inadequate nutrition, neglect, careless parenting, etc.

### Malnutrition:

Nutrition is an essential component of efforts to reduce infant mortality. Every single cell, organ and system inside a newborn baby comes mostly from her mother's food intake before or during pregnancy. The poor maternal nutrition can contribute directly or indirectly to infant mortality. The nutritional excesses such as vitamin A, deficiencies in B vitamins, vitamin K, magnesium, copper, and zinc are linked to birth defects (Rush, 2001). The factors like chronic hypertension, diabetes, infections and stress as well as the woman being underweight or obese before pregnancy are major causes of preterm delivery. Nutritional deficiencies can cause anemia. Maternal anemia can also contribute to infant death and disabilities associated with obstetrical hemorrhage (Pelletier *et al.*, 1994).

### Shaken Baby Syndrome:

Babies have weak neck muscles and often struggle to support their heavy heads. If a baby is forcefully shaken, his/her fragile brain moves back and forth inside the skull. This causes bruising, swelling and bleeding. It usually occurs when a parent or caregiver severely shaking a baby or toddler due to frustration because the child won't stop crying. Shaken baby syndrome is a form of child abuse that can result in permanent brain damage or death (Callaghan *et al.*, 2006).

**Munchausen Syndrome by Proxy:**

Munchausen syndrome by proxy is a mental illness and a form of child abuse. The caretaker of a child, usually a mother, either makes up fake symptoms or causes real symptoms to make it look like the child is sick. No one is sure what causes Munchausen syndrome by proxy. Sometimes the person was abused as a child or has fake illness for themselves (Dubowitz *et al.*, 2011).

**Sudden Infant Death Syndrome:**

Sudden infant death syndrome (also known as SIDS) is defined as the sudden, unexpected death of an infant younger than 1 year of age. If the child's death remains unexplained after a formal investigation into the circumstances of the death (including performance of a complete autopsy, examination of the death scene and review of the clinical history) the death is then attributed to SIDS. Sudden infant death is a tragic event for any parent or caregiver (Marian *et al.*, 2013).

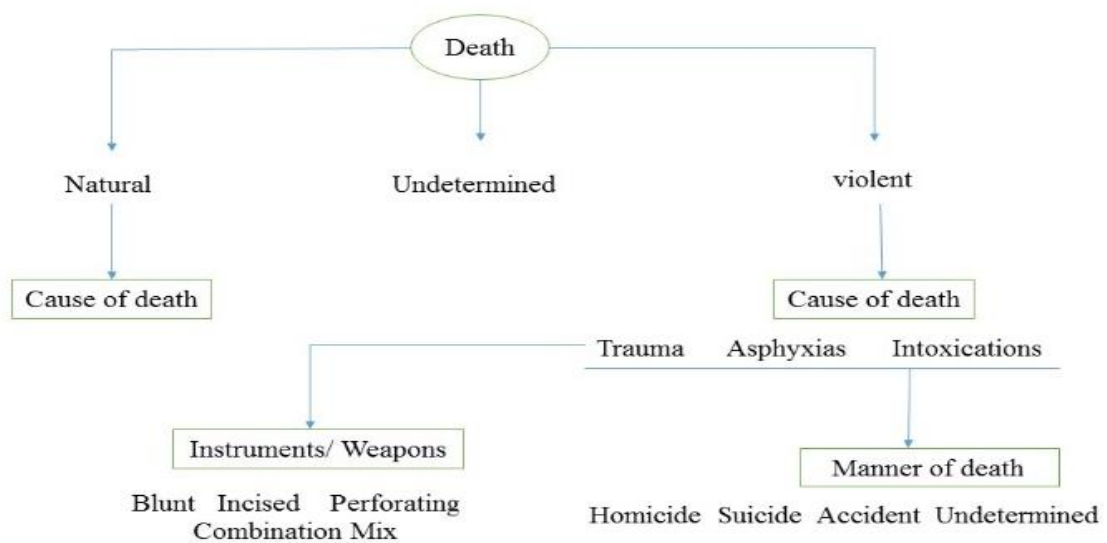


Fig. 1. The types and causes of the death

**4. FORENSIC SCIENCE CASEWORK**

Forensic science is application of scientific knowledge and methodology to legal problems and criminal investigations. Forensic scientists are required to appear in court as expert witnesses. The forensic services are excellent indicators of what has occurred at the crime scene. The investigators who handles child fatalities must have a basic understanding of the Shaken baby syndrome, Munchausen syndrome by prox and Sudden infant death syndrome (Marian *et al.*, 2013). The infant medical history including prenatal, delivery and postnatal information allows the investigators to focus the investigation. The assessment of the mental health of the caregiver allows the investigator to determine the role that these factors may have played in the infant’s death (Randy *et al.*, 2007).

**Crime scene investigation:**

The crime scene investigation is the use of deductive and inductive reasoning to gain knowledge of the events surrounding the crime scene. Its objectives are the collection, preservation, packaging, transportation and documentation of physical evidence left at the crime scene (Fisher, 1993). The crime scene should be documented in narrative form and augmented with photographs and diagrams. It should be conducted by a medical examiner, coroner, or a person known to and acting officially on behalf of the medical examiner or coroner.

Infant death scenes may be crowded with emotional of family members and witnesses. The family members and other witnesses may pose potential risks to investigators and must be controlled or removed from the scene before starting the investigation (Randy *et al.*, 2007).

Investigation of infant mortality are based on data from the police and judicial system, data from infant's parents and relatives, and neighbors through interviews and forensic DNA analysis. All interviews should be conducted by appropriate personnel, following proper legal procedures and using appropriate interviewing techniques (Kotabagi *et al.*, 2002). The interviews must be conducted in a professional and sensitive manner, if any useful information is going to be obtained.

The investigators should consider the information from a caregiver's interviews, medical status, family history, antemortem and postmortem evaluation (Randy *et al.*, 2007). They also work to determine the causes and manner of deaths whether the death was natural, accidental, homicidal or premature deaths. All physical evidences should be collected, preserved, documented and transported to the laboratory.

#### **DNA dragnet:**

It is techniques used for apprehending criminal suspects or other wanted persons (Abhinav and Garima, 2012). In the cases under which the infant's dead body found somewhere else without her/ his known parents, the investigators work to determine her/his parents or relatives by using DNA dragnet process where DNA samples may be taken from a large group of individuals lives in that region without warrants for further used in paternity testing. Y-Chromosome and Mitochondrial DNA analysis may be used in this cases. Testing the Y-chromosome provides information from male line, which means the father to his father and so on. Mitochondrial DNA is maternally inherited therefore all of the individuals in the maternal lineage of a family (i.e. mother, daughter, sibling) will share the same mitochondrial DNA (Klaus *et al.*, 2000).

DNA profile from a crime scene is compared with a DNA sample from a suspect or DNA profile of the database. If the two DNA profiles are matched, then the evidence came from that suspect. Conversely, if the two DNA profiles do not match, then the evidence cannot have come from the suspect. The blood and other biological samples must be taken as toxicological tests to test whether any poison was the cause of death.

#### **Autopsy:**

The autopsy is a postmortem examination to discover the cause and manner of death (Kotabagi *et al.*, 2002). In the cases of infant mortality the pathologists and other forensic experts should investigate the causes, manner and post mortem interval (PMI) of infant's deaths.

The pathologists perform autopsies when the death is known or suspected to have been caused by apparent criminal violence, when the death is unexpected and unexplained in an infant or child, when the death is associated with police action, when the death is apparently nonnatural and in custody of a local, state, or federal institution, when the death is due to acute workplace injury or electrocution, when the death is by apparent intoxication by substance abuse, when the death is caused by unwitnessed or suspected drowning and when the body is unidentified.

The autopsy conduct external and internal examination of the dead body. External examination of the infant provides information about the state of care, injuries and presence of illness. Although injuries may not be visible on the external surface of the body, their presence immediately alerts the investigator to the possibility of an unnatural death (Inanici *et al.*, 1998).

The macroscopic, microscopic, serological, chemical and genetic analysis must be evaluated. The forensic scientists should investigate and report whether the newborn was born alive, he /she died during birth, he /she was premature, he /she died after birth and whether was killed or he /she got an accident.

#### **Report of infant mortality:**

Forensic science reports must be reliable, description of findings and include interpretations and opinions to make them informative. The cause of death is assigned by the official certifier, typically the medical examiner or coroner for the medicolegal jurisdiction where the death was reported. The infant mortality should be reported either accidental, homicide, suicide and undetermined death. In report some information are very important like unsafe sleeping, recent hospitalization and Previous medical diagnosis, recent fall or other injury, Prior sibling deaths, history of religious, cultural or ethnic remedies (Mosher, 1985). The final report must include the identity of witnesses and detailed statements from the individual(s) who can confirm the circumstances and time that the infant was last known to be alive.

### Pre-Autopsy report:

Pre-autopsy report of infant mortality must have informations taken from before birth, during birth, neonatal and postnatal period, and the situation in which the child was living. The report about before birth of infants may constitute informations such as State whether the child's mother didn't /or she wanted the pregnancy, the situation under which the child's mother was receiving medical care, the situation in which the mother of child had a chronic disease or a drug addict, etc.

The report about childbirth may include the informations such as place of birth and the personnel who supervised the delivery process, the child's weight and length at the time of birth, indicate whether the delivery was swift or difficulty, indicates whether there was defects or congenital anomalies at the time of birth, etc.

The report about neonatal and postnatal period should include the information such as the type or kind of infant's feeding given to the infant, the infant's development, the daily infant's behaviors, situation in which the infant's mother under went postnatal care and indicate whether the child's mother had any disease or accident.

The report from the condition of the infant's parents may include information such as situation under which the infant's parents either divorced or are still together, situation under which the infant's parents are unemployed or have economic distress, the infant's parents level of education, it shows the condition under which the infant's family either have conflict or domestic violence, it shows whether the infant's parent have shown the required social support to the infant, it shows whether the child's parents have any psychiatric problems, it shows whether the infant's mother was raped during marriage time, force pregnancy or any other kind of sexual abuse, it shows whether there have been any previous unexplained deaths of infant or child siblings (If so, relevant details should be obtained), it shows also whether there have been previous social service or police contacts or interventions in the home (If so, the details should be obtained), etc.

### Autopsy report:

Postmortem inspection and forensic autopsy reports may include the date, place, and time of examination; the name of deceased (if known); the case number; a description of internal and external examination; descriptions of findings in sufficient detail to support conclusions; a list of the diagnoses and interpretations; cause and manner of death; include also the name and title of each forensic pathologist and forensic expert involved.

### Release Jurisdiction of Body:

The investigator releases jurisdiction of the body after examination by the pathologist and other forensic experts. The investigator verifies all information required to complete the death certificate, including demographic information, date, time, and location of death (Randy *et al.*, 2007).

## 5. CONCLUSION

The infant mortality investigation may involve multiple medical, legal and social agency representatives. It is essential to maintain a proper chain of custody for evidence. The expert testimony must be admitted based on the expert's credentials, experience, skills and reputation. The expert's conclusion should be exposed through cross-examination. The post mortem examination only does not necessarily answers all the key questions involved in the cases of infant mortality.

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