



**St. Paul's Hospital
Millennium Medical College**
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**PROFILE OF MEDICOLEGAL AUPTOSY CASES OF INFANTICIDE IN
ETHIOPIA, ST. PAUL'S HOSPITAL MILLENIUM MEDICAL COLLEGE,
ADDIS ABABA.**

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Addis Ababa, Ethiopia

November, 2022 G.C

St. Paul's Hospital Millenium Medical College
Department of Forensic Medicine and Toxicology

PROFILE OF MEDICOLEGAL AUTOPSY CASES OF INFANTICIDE IN
ETHIOPIA, ST. PAUL'S HOSPITAL MILLENIUM MEDICAL COLLEGE,
ADDIS ABABA.

**A Thesis report for partial fulfillment of specialty training submitted to ethics
clearance committee, St. Paul's Hospital Millenium Medical College through
Department of Forensic Medicine and Toxicology.**

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Addis Ababa, Ethiopia

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Submission Guide

Name of the Investigator	Dr. Getachew Ababu (MD, FMT Resident)
Full title of the research project	Profile of Medicolegal Cases of Infanticide in Ethiopia, SPHMMC, Addis Ababa
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Abstract

Introduction: Infanticide is unlawful destruction of a child under the age of one year by anyone, excluding the death of fetus during labor. These acts have existed since the dawn of humanity. Homicide is the leading cause of infant deaths due to injury, accounting for almost one third of such deaths in 1996. More than 80 percent of documented homicides in very young children can be viewed as fatal child abuse, and there is strong evidence that both homicides and fatal cases of child abuse are undercounted. Some tribes in the remote valley of the lower Omo River in South-West Ethiopia, regularly conduct a practice of infanticide on children who are born out of wedlock.

Objective: The aim of this study is to provide comprehensive report on profile of infanticide cases and make better understanding of epidemiology and burden of infanticide cases of medicolegal autopsy and to create awareness and preventive measures.

Methods: An institution-based cross-sectional study was conducted at department of Forensic Medicine and Toxicology department of St. Paul's Hospital Millennium Medical College from November 2021 to October 2022. All cases of live born infants came for medicolegal autopsy with suspect of infanticide which are determined to be homicidal were included in the study by non-probability convenience sampling method.

Results; Total of 4,342 cases were subjected to forensic autopsy in SPHMMC, Addis Ababa, Ethiopia, during the study period. Among these, 1.7% (72) were cases of infanticide. Among total of 72 infanticide cases, majority were females accounting for 55.6% (40) and the remaining 44.4% (32) The study also shows that 81.9% (59) of infanticide cases occurred in the first month, neonatal period, and only 18% of the cases occurred beyond neonatal period. Among the total of 72 infanticide cases, 86.1% of the cases were concealed while the remaining cases were found dead at home. Among the total of 72 cases, 39 cases (54.2%) were evidenced to be live born by a positive hydrostatic test, 12 cases (16.7%) by presence of milk in the stomach, 8 cases (11.2%) by vital reactions at the umbilical stump. The study identified that act of neglect or omission was identified in 44.5% (32) of the total study population, and not identified in 55.5% (40) of the cases.

Key words: Live born, Infanticide, Medicolegal Autopsy

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Abbreviations and Acronyms

- 1) CI: Commulative Interval
- 2) FMT; Forensic Medicine and Toxicology
- 3) IRB: Institutional Review Board
- 4) OR: Odds Ratio
- 5) SPMMC: St. Paul's Hospital Millenium Medical College
- 6) SPSS: Statistical Package for Social Sciences
- 7) USA: United States of America
- 8) WHO: World Health Organization

1. Introduction

1.1 Background

Forensic pathology is the study and application of effects of violence or natural disease in or on the human body, in determining cause or manner of death [1]. Autopsy is highly specialized surgical procedure that consists of a thorough examination of a corpse by dissection to determine the cause and manner of death to evaluate any disease or injury that may be present and for research or educational purposes or to aid justice [2].

Infanticide is derived from the Latin *infanticidium* and incorporated into English by the 17th century, it was initially used to describe the practice of abandoning or killing children shortly after birth—a form of family limitation that was supposedly sanctioned by certain ancient and tribal communities but eventually outlawed by Christianity.(3) Infanticide is unlawful destruction of a child under the age of one year by anyone, excluding the death of fetus during labor.(1) Generally, infanticide refers to the killing of a young child under the age of 12 months, with the term neonaticide being reserved for murders where the victims are under 1 month of age.

Filicide, infanticide, and neonaticide are distinct concepts of the same reality and, despite our unified cries of love for our children, occur daily in contemporary society. These acts have existed since the dawn of humanity and have been in the literature from the earliest eras of recorded history. These crimes can be perpetrated by the mother, the father, or by both and include stepparents and other parental figures. Despite the evolution of scientific knowledge on this type of crime, in some countries, filicide is a verdict that applies only to the killings carried out by mothers. However, in Western countries, men have become increasingly likely to be convicted of killing their child. (7)

The majority of neonaticides occur within several hours of birth and are a response to unwanted pregnancies and deliveries. The assessment of such cases is often difficult as the bodies of the victims are usually hidden and injuries may not be found on autopsy examination. Due to the unique situation of a newborn child, simple omission of adequate care may result in rapid death. Even determining whether an infant was alive at the time of delivery may not be possible from the

scene and autopsy investigations. Further methods for determining whether live birth had occurred or whether the infant was born dead are also inexact and may not be able to be applied with any precision. (5)

To prevent infant homicides, it is important to know the characteristics of the perpetrator and the circumstances of the incident. Several studies have suggested, among other causes, child maltreatment (which turns out to be fatal), altruistic reasons, psychotic symptoms, spouse revenge, social factors (e.g., socioeconomic conditions), or the existence of diseases or malformations in children as causal factors for the crime. (4) According to Raskin, the killings are divided into five categories by apparent motive, based on the explanation given by the murderer. “Unwanted child” murders are committed because the victim was not desired or is no longer wanted by the mother; “Acutely psychotic” murders are committed by the mothers under the influence of hallucinations, epilepsy, or delirium; “Altruistic” murders are carried out to relieve the victim of real or imagined suffering, or in association with suicide; “Accidental” murders: murders that lack homicidal intent, are often the result of a battered child syndrome; and “Spouse revenge” murders result from deliberate attempts to make the spouse suffer. (5)

Protective and risk factors to the perpetration of the crime by one or both parents, to examine the gender differences in filicidal offense characteristics and associated variables in order to establish a common profile of filicidal offenders and victims, and to suggest some strategies to prevent this crime. (4) Studies indicated that parents of the victim usually are young, and unmarried mothers with low educational attainment are overrepresented. Other risk factors for the child include parental depression, family financial problems, and residing in households with unrelated male adults. In cases of infant maltreatment leading to death, the victim usually has been physically abused previously and the perpetrator likely is male. (11-16)

Autopsies of childhood deaths caused by accidents, homicides or suicides account for a significant percentage performed in any center. They pose a serious threat to child health and account for 7 to 10% mortality in the world. (2) The most frequent causes of death are injuries to the head or to the internal organs. Other causes include intentional suffocation, shaking, and more rarely, choking or battering. According to WHO estimates, the highest rates of homicide in children under the age of

five are found in sub-Saharan Africa and Northern America, and the lowest in the high-income countries of Europe, and in Eastern and Western Asia. (28)

1.2 Statement of the problem

Homicide is the leading cause of infant deaths due to injury, accounting for almost one third of such deaths in 1996. Among children and adolescents, homicides are most likely to occur in the first year of life, with similar or higher rates only during later adolescence. (20-23) It is very difficult to get accurate figures on the incidence of neonaticide and infanticide since many cases are never discovered; official figures are likely to be an underestimate. (9) More than 80 percent of documented homicides in very young children can be viewed as fatal child abuse, and there is strong evidence that both homicides and fatal cases of child abuse are undercounted. (24-26)

It is however, estimated that 95,000 child homicides took place, globally, in 2012 alone translating into a rate of 8 per 100,000, with the highest rates reported in Latin America (12 per 100,000) and East and Central Africa (10 per 100,000). (19) Infanticide has become less common in the Western world. The incidence of infanticide is estimated to be 8/100 000 in the USA and less than 3/100 000 in Canada. (10) It is thought that infanticide today continues at a much higher rate in areas of extremely high poverty and overpopulation.

According to a report published in the UK's Telegraph on 14 April, in the remote valley of the lower Omo River in south-west Ethiopia, a tribe known as the Kara regularly conducts a practice of infanticide on children who are born out of wedlock. Married couples are expected to seek permission to get married first, but without contraception it is common to have accidental pregnancies. The babies are believed to be cursed and unclean, and bring bad luck to a family. They are considered evil or, what they call *mingi*. For many generations, the Kara and some other tribes such as the Banna and Hamar have been placing them out in the bush to starve or be eaten by wild animals. There are no official figures, but the numbers of children killed each year is estimated to be 300.(33)

1.3 Significance of the Study

The profiling of medicolegal cases of infanticide is necessary in order to prevent the preventable casualties in future and to study the genuine crime rate in the area. Prevention strategies are most effective when they are targeted with specificity to a problem. We expect that infant homicides do not all fall into a single type. Because strategies that may be effective in preventing one type of homicide may have little impact on another type, it is important to understand the specific types involved.

The profile of medico legal autopsy cases is important in order to know the death statistics in a region due to unnatural causes and also help to address the demographic needs according to the mortality statistics specific to that region. Despite the problem being present in every corner of the country, there is a dearth of research studies on the topic.

This study aims to set up a profile of deaths owing to unnatural causes, in order to better understand the nature and extent of the phenomenon, so that we can direct rigorous efforts to curb their incidence. The finding of this study will create awareness among the people and it will also be helpful for law enforcement agencies to make the strategies for prevention of such incidences.

2. Literature review

The global frequency of infanticide has been estimated to be 1 in approximately 3000 to 5000 children of all ages (34) and 2.1 per 100,000 newborns per year. (35) An 18-year Population-Based Analysis in California, revealed that the incidences of infanticide fluctuated during the interval from a low of 4.8 per 100,000 live births to a high of 8.3 per 100,000 live births in. It was at or below 6 per 100,000 live births in 11 of the 18 years of this study. (37) A study conducted in Fiji, an island in Oceania, showed that 18.5% of criminal homicides in Fiji were classified as maternal infanticides in 1994. (30) A medicolegal study of infanticides in Akita city, Japan showed that from 1984 to 1998, medicolegal autopsies at Akita University Medical School were 39 cases of suspected infanticide (male in 17 cases, female in 19 cases, and unknown in three cases. (31) A study in India, interviewing 1,000 women regarding pregnancy outcomes, found that 41% of the early neo-natal female deaths are due to female infanticide. Another study in Tamil Nadu estimated that 8–10% of infant deaths in 1995 could have been due to female infanticide. (33) A retrospective cross-sectional study on homicide in neonates, infants and children under 5 years in South Africa revealed that among the total of 454 cases of homicides among children under 5 years, more than half (53.2%; 95% CI 46.7%, 59.5%) were neonates, and 74.4% (95% CI 69.3%, 78.9%) were infants, giving a neonaticide rate of 19.6 per 100,000 live births and an infanticide rate of 28.4 per 100,000 live births. (5)

There is non-significant difference between number of male and female infants (p value >0.05) although the percentage of females (60%) was more than that of males (40%), according to the study in Egypt. (29) The study in South Africa showed that 56% of male homicides taking place in an urban setting compared to 44% of female homicides, and that overall, significantly fewer boy children were killed in rural settings than in urban settings (OR 0.61; 95% CI 0.41, 0.90; $p = 0.015$). (6)

In a study on risk factors of infant homicide in United States, of the 2776 homicides identified between 1983 to 1991, one quarter occurred by the end of the second month of life, one half by the fourth month, and two thirds by the sixth month, five percent of the homicides occurred during the first day of life. (7)

A retrospective study conducted in Egypt showed that the highest percentage of notification way legal authorities was found by known person which represented 65.71% of total cases while notification by phone calls from unknown persons represented 20% of total, by moving police cars represented 14.29% of total cases. (8)

According to the retrospective study in Egypt, the identities of infants and accused were known only in 14.29% of total cases. (29) Another retrospective study in South Africa verified that mothers were identified or suspected as the perpetrators in nearly two-thirds of the homicides (71.0%) and in all of the neonaticides; few children were killed by strangers (2.5%), and one in five of the children were killed in the context of a family murder (with one or more other family members also killed). The age of the mother varied from 16 to 49 years. In 17 cases the mothers were in their thirties, four in their teens, six in their twenties, seven in their forties and the age for five of the mothers was unknown. (9)

In Assuit Governorate of Egypt, it's showed that the highest percentage of concealed infants was found in rubbish heaps in the streets 31.43% (11 cases). Eight cases were recovered from canals (22.86%). Seven cases were found inside and outside different buildings (20%) distributed as the following (3 cases found inside and around apartment buildings, 1 case was found inside desert building, 1 case in front of school, 1 case in front of coffee shop, 1 case in front of healthcare center). Five cases were found upon bridges (14.29%). Two cases were found inside hospital's toilets (5.71%). Two cases were found at side roads (5.71%). The difference is statistically significant ($p \text{ value} \leq 0.05$). (29) The study of infanticides in Akita city revealed that the babies were discovered in various places, but in many cases, they were discovered in or around the mother's home. Out of the 39 cases, nine cases were discovered in the family toilet, four in other toilets, five in a family closet, seven in other rooms, three in a shed or storeroom, one in a pay locker, and nine in outdoor areas, and so on (8) The study in South Africa revealed that the infant's home and public spaces were the most common places where the bodies were found, with neonates more commonly found in public spaces. (10)

The wrappings were found in 54.29 % of total cases (in the form of dresses 42.86%, clothes roll 8.75% and blanket 2.86 %) while absence of wrappings was found in 45.71% of total cases of Infanticide in Assuit Governorate, Egypt. The difference between presence and absence of wrappings was statistically non-significant (p value >0.05). (15)

Concerning autopsy examination findings, the mean mass of the abandoned neonates was above 2,700 gm, according to the South African retrospective study. (11) The Egyptian retrospective study has showed that non-medical ligation of cord represented 65.72% of total cases, while medical ligation of the cord was found in 28.57% of total cases, and separation of the umbilical stump was found in 5.71% of total cases. The difference is a highly statistically significant (P value ≤ 0.01) (16) In addition, the presence of putrefaction, hypostasis and rigor mortis hypostasis in 23.81%, 76.19% and 31.43% of total cases, respectively. Neither adipocere nor mummification was detected. There was a highly statistically significant difference between percent of presence and absence of these postmortem changes (P value ≤ 0.01). (7)

The mean gestational age of newborns in the study of South Africa was 38 weeks, with more than 60% (61.5%) were estimated to be term newborns, and only 7.0% were estimated to be preterm. (36) Moreover, similar figures were identified by the Egyptian study that showed the highest percentage of infants were full term which represented 88.57 % while premature infants represented 11.43% of total cases. The difference is a highly statistically significant (P value ≤ 0.01). (8)

The percentage of determined causes of death (85.71%) was more than the percentage of undetermined causes of death (14.29%) as of the retrospective study in Assuit governorate of Egypt. The difference was a highly statistically significant (P value ≤ 0.01). In the determined causes, head injuries constituted the highest percentage (48.57%) followed by omission which represented 28.57% of total. They showed a highly statistically significant difference than other causes of death (P value ≤ 0.01), where drowning represented 5.71% and smothering represented 2.86% of total cases. (29) The most dominant cause of death in 25 cases of live birth was asphyxia in which seven cases were designated as smothering, strangulation, and suspected asphyxia. (31) According to a retrospective study conducted in South Africa, concealed pregnancy was the most

common cause of death overall (38.3%), followed by blunt force (22.1%) and strangulation. For girls 1–11 months old, an undetermined cause of death was the second most common category (22.2%). (12)

Show the determined time passed since death found in 65.71% of total cases distributed as: 17.14 % within 1 day, 17.14% within 1-2 days, 8.57% since 3 days, 11.43 since 3-7 days, 2.86% since 7 days and 8.57% since 7- 14 days. Undetermined time passed since death occurred in 34.29% of total cases (the corpses kept in the hospital refrigerators). The statistical difference between determined and non-determined postmortem interval is highly significant (P value ≤ 0.01). (13)

3. Objectives of the Study

3.1 General Objective

- To determine the profile of medicolegal autopsy cases of infanticide at St. Paul's Hospital Millennium Medical College

3.2 Specific Objective

- To verify sociodemographic characteristics of medicolegal cases of infanticide
- To determine the sociodemographic characteristics and the motive for the offence by the mother and/or the assailants of known identity.
- To determine circumstance of death, cause of death and postmortem interval of the cases

4. Methodology

4.1 Study Design

An institution-based cross-sectional study design was employed.

4.2 Study Period

The study was conducted from November 2021 to October 2022 G.C.

4.3 Study Setting

St. Paul's Hospital is one the tertiary Hospitals in the country, located in *Gulele* Sub-City, Addis Ababa, Ethiopia. It currently has more than 700 beds, sees an average of 1200 emergency and outpatient clients daily, with an annual average of 200,000 patients and a catchment population of more than 5 million.

The college has more than 2800 clinical, academic and administrative and support staffs that provide medical specialty services to patients who are referred from all over the country. St. Paul's Hospital Millennium Medical College provides healthcare and training to its students through its different biomedical and clinical departments, including Anatomy, Physiology, Biochemistry, Pharmacology, Public health, Pathology, General Surgery, Internal Medicine, Obstetrics and Gynecology, Pediatrics and child health, Emergency Medicine, Urology, Neurology, Orthopedics, Psychiatry, Ophthalmology, ENT, Dentistry and Maxillofacial Surgery, Radiology, Anesthesiology, Nursing, ICU (Intensive Care Unit), ART (HIV care), Endoscopy, Physiotherapy, Laboratory and Pharmacy .

Forensic Medicine and toxicology department is one of the departments in SPHMMC, it has authoritative and reliable services which provides over 5000 postmortem examinations annually, that accounts for more than 13 cases per day on average. In addition, the department delivers significant services like medicolegal age estimation cases and sexual assault allegations based on police request to contribute for appropriate justice in time.

4.4 Population

4.4.1 Target Population

The study population was all cases of alleged infanticide brought for medico legal autopsy to the mortuary of department of forensic medicine and toxicology, St Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia.

4.4.2 Study Population

The study was conducted on cases of suspected infanticide brought for medico legal autopsy during period of study to mortuary of the department of forensic medicine and toxicology, St. Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia.

4.4.3 Eligibility criteria

4.4.3.1 Inclusion criteria

All live born infants which are determined to be homicidal were included in the study.

4.4.3.2 Exclusion Criteria

- Deaths of infants due to other causes than the crime of infanticide
- Deaths of infants due to labor and delivery problems as obstructed, precipitate labor
- Cases associated to maternal death or diseases
- Deaths with findings suggesting natural cause of death
- Advanced Decomposed and mutilated body

4.5 Sample Size and Sampling technique

4.5.1 Sample size

Sample size was calculated by sample size determination formula with 95% level of confidence. Since there is no study was conducted the study area by the same or related topic, the population proportion (P) was taken as 0.5 with 0.05 sampling error (d)

$$LC\ 95\% \Rightarrow 1.96 = z\alpha/2$$

$$P = 0.5$$

$$D = 0.05$$

$$n = ?$$

$$n = \frac{(z\alpha/2)^2 pq}{d^2} = \frac{(z\alpha/2)^2 p(1-p)}{d^2} \text{ where } q = (1-P)$$

$$n = \frac{(1.96)^2 0.5 (1-0.5)}{(0.05)^2}$$

$$n = 384$$

From the previous data of autopsy case pattern of 8 months, we have quite small number of medicolegal cases of infanticide per month that is only about 8-10 cases, that makes difficult to get enough number of samples with in the study period, and the total population is less than 10000, so, population correction was used to get the desired sample size.

n = the desired sample size

n_o = initial total sample size

N = Total population

$$n = \frac{n_o}{1 + (n_o/N)} = \frac{384}{1 + (384/90)} = \frac{384}{5.3} = 72$$

4.5.2 Sampling technique

Non-probability convenience sampling method was used, so that all cases fulfilling the inclusion criteria available during study period was be included until to get the desired sample size.

4.6 Study Variables

4.6.1 Dependent Variables

Un-natural death of children under 1 year

4.6.2 Independent Variables

- Identity of the infant: known/unknown
- Age
- Sex of the infant
- Place of concealment
- Presence or absence of wrapping
- Sociodemographic variables of the mother/ assailant
- Postmortem changes
- Umbilical cord condition
- Stage of Maturity (Term/Preterm)
- Cause of death in medical certificate of death
- Postmortem interval

4.7 Study Instruments

A well-structured self-filled predesigned and pretested questionnaire for data collection on pre autopsy interview is developed depending on international Standard Verbal Autopsy Questionnaire, which may aid uncovering of more specific and appropriate information some modifications.

For data collection on postmortem findings suggesting the cause of death, a well-structured self-filled predesigned and pretested proforma is developed depending on standard book sample

formats and other similar studies with some modifications which comprised relevant data in order to attain the objective of this study.

4.8 Data collection and procedures

Information regarding the bio data of the deceased and various factors regarding the circumstances of death were gathered primarily from the police, police records, hospital records, death certificates and also by direct interrogation of the investigating officer with the eye witnesses, relatives and friends of the deceased helping the investigating officer in case of doubt in the mind of the police. The information was gathered by the investigator and not by trained data collectors.

Complete autopsy including biochemical and pathological examinations were performed following standard procedures and recorded as described in standard books

The Autopsied specimens were examined to rule out natural cause of death whole organ or pieces of organ showing gross pathologic changes was be preserved by fixing in 10% formalin for histopathological examination. Multiple sections were prepared with 4-5 mm thickness. Additional sections were taken wherever necessary. Tissues were processed and subjected to paraffin section at 4- μ m thickness, and then were stained with routine hematoxylin and eosin staining method. Samples of tissue were preserved for further analysis based on necessity.

4.9 Operational Definitions

- **Neonaticide:** intentional killing of a child within 24 hours of birth.
- **Infanticide:** an unlawful killing of a child below the age of 1 year; doesn't include death during labor by craniotomy and decapitation.
- **Filicide:** is killing of a child older than 24 hours by its own parents.
- **Homicide:** It is killing of a human being by another human being
- **Medicolegal Autopsy:** It is the examination of a person's body after his death virtually done when some legal issue is involved like homicide, accident, suicide or any other suspicious death
- **Still birth:** A stillborn child is one which is born after 28th week of pregnancy and which did not breathe or show any other signs of life at any time after being completely born [WHO]
- **Maceration:** (Latin macerare, to soften by soaking) is degenerative change occurring in a fetus retained in utero after death
- **Maturity data:** Data which includes the crown-heel length of a mature newly born child is about 48–52 cm, crown rump length about 28–32 cm, head circumference about 30–35 cm, and weight about 2.5 to 3.3 kg.
- **Postmortem interval:** Is an interval between death and the time of postmortem examination
- **“Unwanted child” murder:** murders that are committed because the victim was not desired or is no longer wanted by the mother
- **“Acutely psychotic” murders:** murders committed by the mothers under the influence of hallucinations, epilepsy, or delirium
- **“Altruistic” murders:** murders carried out to relieve the victim of real or imagined suffering, or in association with suicide
- **“Accidental” murders:** murders that lack homicidal intent, are often the result of a battered child syndrome.
- **“Spouse revenge” murders:** result from deliberate attempts to make the spouse suffer.

4.10 Data Quality Control and Management

To keep the quality of data the predesigned semi structured proforma were pretested by the principal investigators. If necessary, amendment was made to ensure their accuracy and consistency prior to actual collection of data. The investigators performed the supervision of data collection procedures on daily basis. They checked every completed questionnaire. Anything, which is unclear and ambiguous, was discussed on a daily basis. Any error, ambiguity, incompleteness encountered was addressed before starting next activities.

Data was cleaned with consistence checks and analyzed using the same SPSS package. The data were cleaned for impossible and missed values together with consistence checks on daily basis. Any errors identified at this time were corrected after revision of the original data using the code numbers.

4.11 Data Analysis

Data analysis was done using SPSS version 26. The descriptive analysis such as proportions and percentages were done. A two-step logistic regression (bivariate and multivariate) analysis was done to see the effect of the independent variables on the dependent variable. The significant level is considered at $P < 0.05$. Explanatory variables with ($P\text{-value} < 0.25$) were entered into the final logistic regression (multivariate) model based on the likelihood ratio. Then, the strength of association between the independent variable and the dependent variable was assessed using OR and 95% CI; adjusted OR for explanatory variables will be also determined. Finally, the finding was presented by using tables and graphs as appropriate

4.12 Ethical Considerations

The study was started after approval of Saint Paul's hospital and Millennium Medical College Institutional Review board (IRB). Information used in this study was anonymized. Serial numbers were assigned to individual cases, and the information is stored on a secured computer.

The study involves medicolegal cases brought to the mortuary by the police and not the relatives of the deceased. The information was taken primarily from the police allowing the relatives to be present during history taking only to help the police. The information gained from the history and postmortem examination was included in the post mortem report to help in the investigation by the police.

The identification details of the deceased were not revealed at any stage. Therefore, grant for waiver of informed consent was given from the IRB because of the anonymization of the data, the potential value that the findings may add to forensic practice, national policy formulation and prevention and the low risk involved in the use of the data.

4.13 Dissemination of the results

The result of the study was presented and submitted to Saint Paul's hospital and Millennium Medical College community and academicians. Additionally, the study result may be disseminated to Federal ministry of health, to the Federal police commission and academic partners working on this area of expertise, further attempt will be made to publish it on national and international scientific journals.

5. Results

Total of 4,342 cases were subjected to forensic autopsy in SPHMMC, Addis Ababa, Ethiopia, during the study period. Among these, 1.7% (72) were cases of infanticide.

Among total of 72 infanticide cases, majority were females accounting for 55.6% (40) and the remaining 44.4% (32) were males, making male-to-female ratio of infanticide 4:5.

The chart below shows sex distribution of infanticide autopsy cases

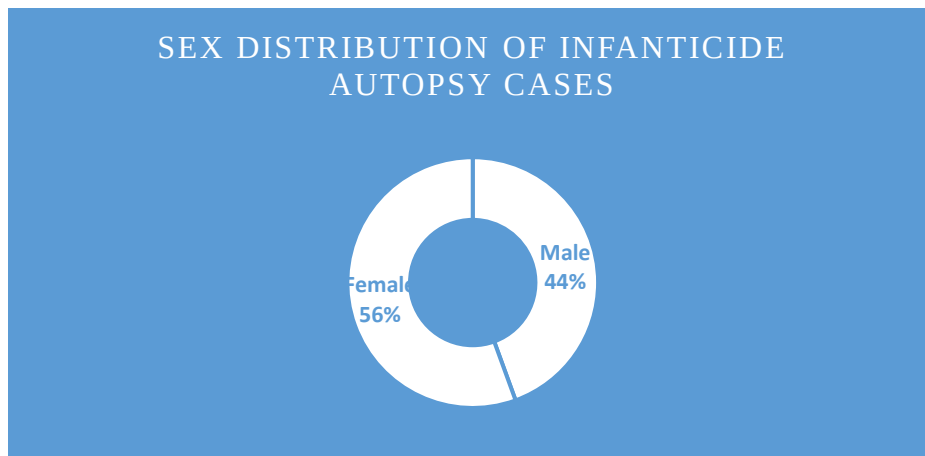


Figure 1. Sex distribution of infanticide autopsy cases

The study also shows that 81.9% (59) of infanticide cases occurred in the first month, neonatal period, and only 18% of the cases occurred beyond neonatal period. Beyond neonatal period 8.6% (6) occurred during the second through sixth months of life and the reminder 9.7% (7) took place during second half of infancy.

The table below demonstrates age distribution of infanticide.

Table 1. Age distribution of infanticide autopsy cases

	Age	
	Frequency	Percent
below 1 month	59	81.9
1-6 months	6	8.3
7-12 months	7	9.7
Total	72	100.0

The identities of the infants and of the suspected offenders were known only in 19.4% (14) and 4.2% (3) of total infanticide cases, respectively.

Among the total of 72 infanticide cases, 86.1% of the cases were concealed while the remaining cases were found dead at home, and a case was abandoned by the mother at hospital. Highest percentage of concealed infants were found from road side (21) which accounts 29.2 in percent, 13 infants were recovered from river, and 12 infants were found in rubbish heaps. The place of concealment for remaining cases were reported to be toilet (6), water pits (5), and in or around buildings (5).

The table below shows place of concealment of infanticide cases.

Table 2. Place for concealment of infanticide autopsy cases

	Place of concealment	
	Frequency	Percent
Rubbish heaps in streets	12	16.7
Inside and around buildings	5	6.9
Road side	21	29.2
Water pits	5	6.9
Toilet	6	8.3
River	13	18.1
Total	62	86.1

From our total study population 72 infanticide cases, three-fourth (54, 75%) were from Addis Ababa and about a fifth (15, 20.8%) were from Oromia.

The following chart depicts regional distribution of infanticide autopsy cases seen at forensic medicine department of SPHMMC

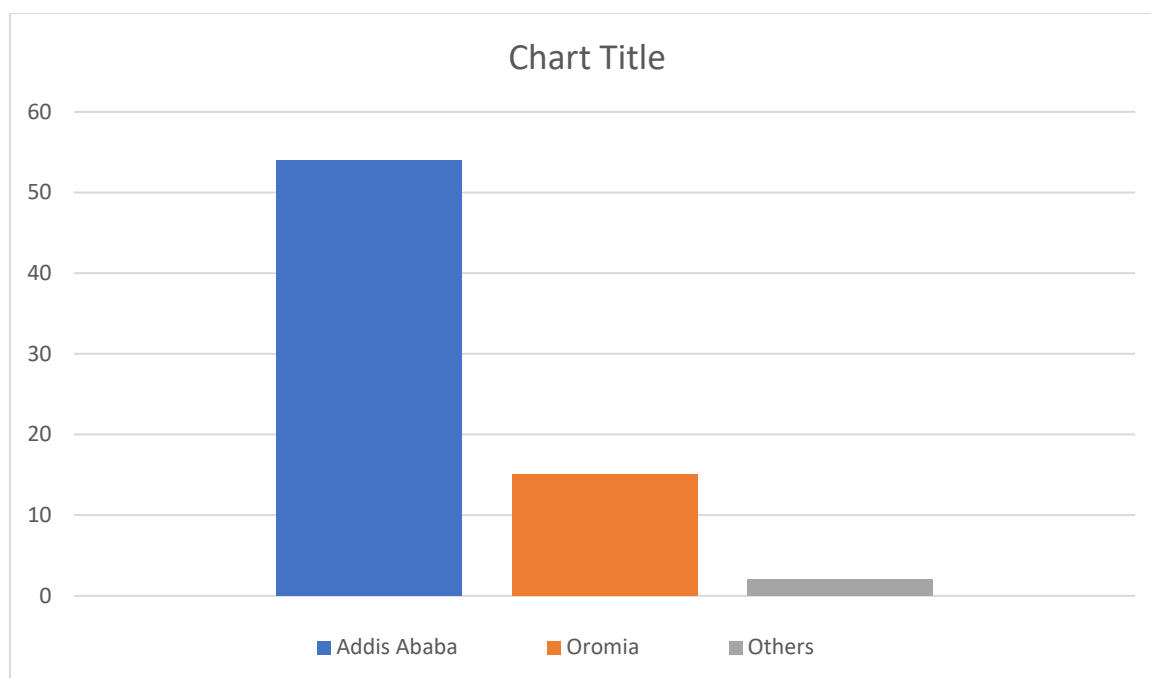


Figure 2 Regional distribution of infanticide autopsy cases

The infants had some sort of wrapping i.e., 27.8% (20) had cloth roll, 20.9% (15) had wear dress, and 15.3% (11) had blanket. However, 36.1% (26) were in plastic bags.

The following table shows clothing/ wrapping of the cases

Table 3 Clothing or wrapping of the infanticide autopsy cases

	Clothes or wrappings	
	Frequency	Percent
Wear dress	15	20.9
Cloth roll	20	27.8
Blanket	11	15.3
Plastic bag	26	36.1
Total	72	100.0

Among the total of 72 cases, 39 cases (54.2%) were evidenced to be live born by a positive hydrostatic test, 12 cases (16.7%) by presence of milk in the stomach, 8 cases (11.2%) by vital reactions at the umbilical stump, and the remaining 13 cases (18.1%) by other means.

The figure below shows evidences of live born for the infanticide cases subject to autopsy at SPHMMC forensic medicine department.

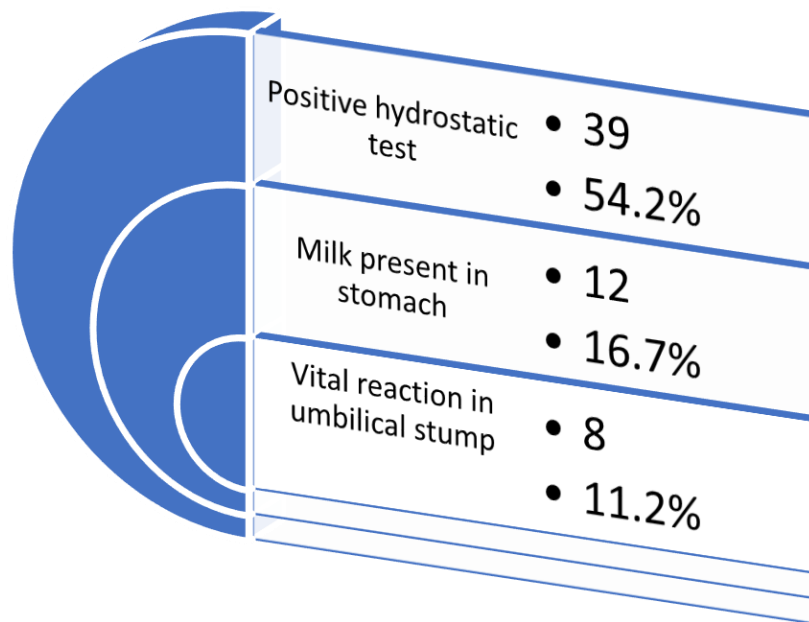


Figure 3 Evidences for live birth of the infanticide cases

There was no physical natural deformity identified in the study, though 27 among the total study population of 72 cases (37.5%) had one or more marks of external violence. Lacerations and abrasion of different extent and site, and amputation of one or more limbs with or without loss of the limb, account for most of the identified marks of external violence. Other than the marks mentioned, ligature marks around the neck, stab wounds, animal bites, skin loss and burn wounds were also identified as marks of external violence.

The study shows that the end of umbilicus was ragged in 33.3%, has clean cut in 12.5%, was still attached to the placenta in 18.1% of the total study population. Umbilicus in eight out of 72 cases had hospital cord tie attached to and 5 were tied.

Table 4 Umbilical cord condition of the infanticide autopsy cases

	Umbilical cord condition	
	Frequency	Percent
Tied	5	6.9
Attached to placenta	13	18.1
Hospital cord tie attached	8	11.1
Ragged	24	33.3
Clean cut	9	12.5
Total	59	81.9

As shown in the table below, about 96% (69) of the total study population are term, and only 3 out of 72 cases were preterm.

Table 5 Degree of maturity of infanticide autopsy cases

	Degree of maturity	
	Frequency	Percent
Term	56	94.9
Preterm	3	5.1
Total	59	100.0

As shown in the chart below, the cause of death is determined in two-third cases of the total study population, and could not be determined in the remaining third of the cases. Head injury is identified to be the most dominant cause of death accounting for 68% (34) of the cases with determined cause of death and 47.2% of the total study population. Strangulation, drowning, suffocation and poisoning account 8.3% (6), 5.6% (4), 1.4% (1) and 1.4% (1) of the total study population, respectively.

The chart below shows causes of death for infanticide cases, and the table shows causes of death by age and sex.

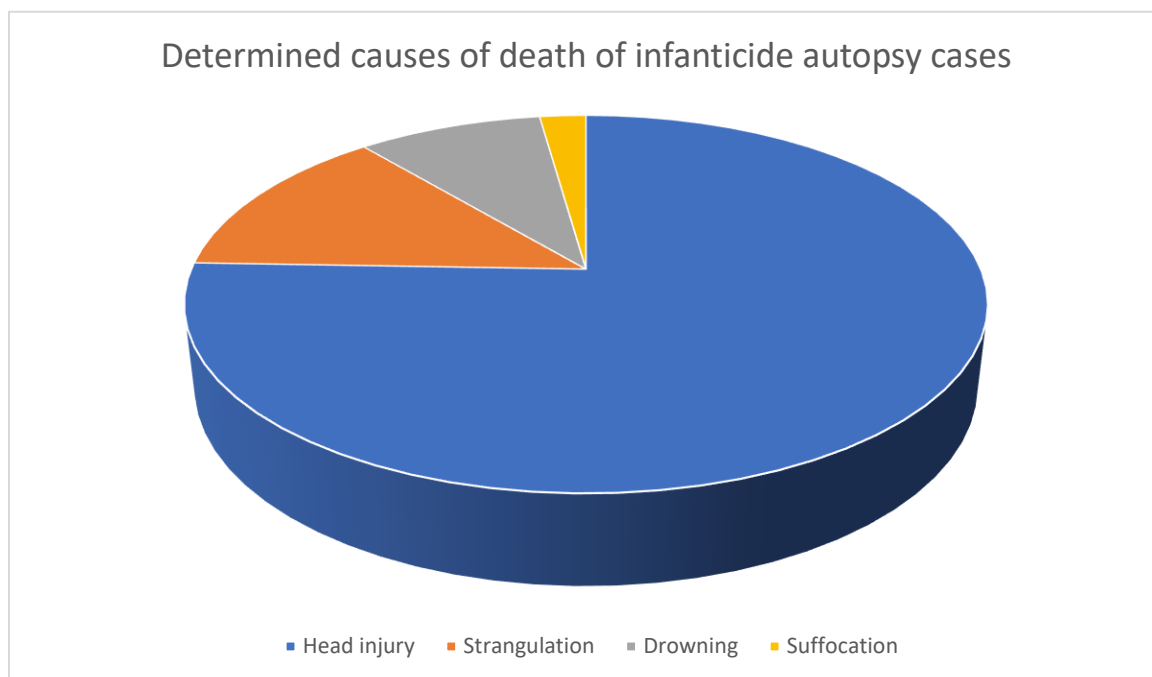


Figure 4 Cause of death for infanticide autopsy cases

Table 6 Cause of death of infanticide autopsy cases by age and sex of the infants

Age	Sex	Causes of death determined						Total
		Suffocation	Strangulation	Drowning	Head injury	Poisoning	Multiple injuries	
below 1 month	Male	1	4	2	12	0	1	20
	Female	0	2	0	18	0	1	21
1-6 months	Male	0	0	0	0	1	1	2
	Female	0	0	0	1	0	0	1
6-12 months	Male	0	0	0	1	0	0	1
	Female	0	0	2	2	0	0	4
Total	Male	1	4	2	13	1	2	23
	Female	0	2	2	21	0	1	26

The study identified that act of neglect or omission was identified in 44.5% (32) of the total study population, and not identified in 55.5% (40) of the cases. Omission to tie the cord is the most common act of omission followed by omission to protect the infant from heat or cold, and omission to feed appropriately.

Table 7 Acts of omission or neglect identified

	Act of omission or neglect identified	
	Frequency	Percent
Omission to tie the cord	19	26.4
Omission to protect the child from heat or cold	5	6.9
Omission to provide appropriate food	1	1.4
Other	7	9.7
Total	32	44.5

Postmortem interval, the approximate time since death during the postmortem examination, is 12-24 hours for 50% of the cases, and 24-36 for 31.9% of the cases. For minority of the cases, the time since death were within 12 hours (9.7%) and 36-38 hours (7.3%).

Table 8 Post mortem interval of infanticide cases

	Postmortem interval	
	Frequency	Percent
Less than 12 hours	7	9.7
12-24 hours	36	50.0
24-36 hours	23	31.9
36-48 hours	6	7.3
Total	72	100.0

6. Discussion

It is very difficult to get accurate figures on the profile of infanticide cases, as the figures are likely to be underestimates for the fact that many cases are never recovered and are underreported. The function of forensic pathologist in infanticide is identification of the infant and mother, determination whether the infant was born a live or still birth, as well as determination of maturity, the cause of death and time passed since death (Sukko and knight, 2004)

This study shows that 55.6% of infanticide cases are female infants and 44.4% of the cases are males. This figure correlates with findings of a retrospective study on medicolegal evaluation of infanticide pattern in Assuit governorate, Egypt from 2008 to 2013, which showed that there is non-significant difference in occurrence of infanticide between sexes, though the percentage of females (60%) was more than that of males (40%). A study conducted in South Africa showed figures that significantly fewer boy children were killed in rural settings, but more male homicides took place in urban settings.

According to this study, the first month, neonatal period of life is shown to be the period for most of infanticide cases to take place, for almost 82% infanticides happened during this period.

According to the retrospective study in Egypt, the identities of infants and accused were known only in 14.29% of total cases. (29) Similarly, this study showed that the identity of the infant was identified in only 19.4% (14) and that of the suspected offender was known in only 4.2% (3) of the cases.

In Assuit Governorate of Egypt, it's showed that among the places of concealment of the infants, rubbish heaps in the streets account for highest percentage followed by water canals, areas around different buildings, up on bridges, and Hospital toilets. Another study of infanticides in Akita city revealed that the babies were discovered in various areas, but in many of the cases they were discovered in or around mother's home. The study in South Africa revealed that the infant's home and public spaces were the most common places where the bodies were found. This study shows most of infants were found on road side (20.8%), 18.1% of the cases were recovered from rivers, 16.7% were found from rubbish heaps, 8.3% were found from toilet, 6.9% from water pits and 6.9% from the inside or around buildings.

This study revealed that 63.9% the infants had wrappings in the form of cloth roll (27.8%), wear dress (20.9%) or blanket (15.3%). These findings are in line with those of a retrospective study in

assuit governorate, Egypt which reported that wrappings were found in 54.3% of total cases, the presence and absence of wrappings was statistically non-significant.

As of the retrospective study in Assuit governorate of Egypt, the percentage of determined causes of death (85.71%) was more than the percentage of undetermined causes of death (14.29%) to the level of highly statistically significant (P value ≤ 0.01). In addition, according to a retrospective conducted in South Africa, cause of death is undetermined in 22.2% of the cases. In this study, the percentage of undetermined causes is 36.2% which accounts for a third of the cases and is much higher than the above two figures; and the percentage of determined causes is 63.8%.

Among the determined causes, in our study, head injury remains to be the most common cause of death (47.2%) followed by strangulation (8.3%), drowning (5.6%), suffocation (1.4%) and poisoning (1.4%). This finding is congruent with those of the retrospective study in Asuit governorate of Egypt which showed that that head injury represented 48.5% followed by drowning (5.71%) and strangulation (2.86%).

The study in Assuit governorate of Egypt showed that omission was identified in 28.57% of the total cases, but in this study, act of omission or neglect was identified in much higher percentage (44.5%).

The retrospective study in Assuit governorate of Egypt has showed that time passed since death was within 1 day in 17.14%, within 1-2 days in another 17.14%, since 3-7 days in 11.43% and more than 7 days in half of the cases. In contrast, this study showed that in 50% of the cases the time passed since death was 12-24 hours and in 31.9% cases it was 24-36 hours; in only 9.7% cases the time passed since death was less than 12 hours and in 7.3% of the cases it was 36-48 hours.

7. Conclusion and Recommendation

Cases of infanticide are underestimated in Ethiopia, perhaps due to limited forensic medicine facilities and lack of reporting and missing of cases in places of concealments.

Good evaluation of infanticide necessitates writing a complete and standard medicolegal report about cases especially police requests are not complete compared to other medicolegal autopsy case.

Reducing number of infanticide cases necessitates

- ✓ Establishment of a specific legislations for infanticide,
- ✓ Increase public awareness to notify about infanticide cases,
- ✓ Improve economic and educational status especially for females in poor areas,
- ✓ Prohibit illegal sexual relationships,
- ✓ Treatment of pregnant mothers suffering from psychiatric disorders,
- ✓ Increase the public awareness about reporting of the crime and attention to social care institution and
- ✓ Prepare adoptive families for infants of unknown parentage.

8. Acknowledgement

I acknowledge Saint Paul's Hospital and Millennium Medical College (SPHMMC) for giving me this chance understanding the importance of the study which gave us some essential information about profile of infanticide cases in Ethiopia.

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10. Appendix

Annex I. Information sheet and informed consent prepared for the probable offender

Information Sheet

Hello, how are you? My name is _____. This is a questionnaire to be filled with you for a study that is being conducted at SPHMMC, Department of forensic medicine and toxicology. The purpose of the study is to assesses profile of medicolegal autopsy cases of infanticide. I would like to ask you some questions that are related to the infanticide cases.

I believe that the results of this study will assist policy makers, planners and health service providers for making considerations regarding medicolegal infanticide cases. It will also help to contribute in the subsequent efforts to improve prevention of infanticide in Ethiopia. You have been selected to participate in this study since you are related to this particular infanticide case. Your contribution has a great input for this academic research so I would greatly appreciate your participation. There is no possible risk associated with participating in this study. Your name will not be written in the questionnaire and please be assured that all the information you give will be kept strictly confidential. Your participation is completely voluntary.

Therefore, you will not be obliged to answer any question that you do not want to and you may end this interview at any time you want. The questionnaire will take about 10-15 minutes.

Informed Consent Form

I have read the information sheet concerning this study (or have understood the verbal explanation) and I understand what will be required of me and what will happen to me if I take part in it. I also understand that any time I may withdraw from this study without giving a reason.

Participant's signature _____ Date _____

Data collector's name _____

Data collector's Signature _____ Date _____

Annex II. Data collection tools

Case code: _____

Self-filled questionnaire

Please put “√” in the boxes in front of your chosen answers and use the dashed spaces to write your answers for respective questions, if required.

1. Identity of the infant: Known ☐ Unknown ☐
2. Sex of the infant: Male ☐ Female ☐ Unknown ☐
3. Identity of the offender: Known ☐ Unknown ☐
4. If known to Q3, what is his/her relation to the infant: A. Parent ☐ B. Other family member ☐ C. Relative/ Friend ☐ D. Other (Specify) _____
5. Maternal age in years: _____
6. Marital status: A. Single ☐ B. Married ☐ C. Divorced ☐ D. Widowed ☐
7. Region of the parent(s): A. Addis Ababa ☐ B. Oromia ☐ C. Amhara ☐ D. Tigray ☐ E. SNNPR ☐ F. Others (Specify) _____
8. Maternal educational status: A. Illiterate ☐ B. Primary school ☐ C. Secondary school ☐ D. Higher education ☐
9. Employment status: Employed ☐ Unemployed ☐
10. Where was the Place of concealment? A. Rubbish heaps in streets ☐ B. Inside and around buildings ☐ C. Side roads ☐ D. Inside hospitals toilet ☐ E. Canals water ☐ F. Upon a bridge ☐ F. Others (Specify) _____
11. What is the motive for the offense? A. “Unwanted child” murder ☐ B. “Acutely psychotic” murder ☐ C. “Altruistic” murder ☐ D. “Accidental” murder ☐ E. “Spouse revenge” murder ☐ F. Other (Specify) _____

Case code: _____

Data collection tools (Proforma)

1. Evidences of live born
 - a. Vital reaction in the umbilical stump ☐
 - b. Presence of milk in the stomach ☐
 - c. Hydrostatic test if applicable ☐
 - d. Others _____
2. Clothes or Wrappings: A. Wear dress ☐ B. Cloth roll ☐ C. Blanket ☐ D. Bare bodies ☐ E. Other (Specify) _____
3. Any physical natural Deformity: Present ☐ Absent ☐
4. If “present” to Q3, Specify: _____
5. Marks of external violence: Present ☐ Absent ☐
6. If “present” to Q5, Specify: _____
7. Foreign body/ies in the mouth: Present ☐ Absent ☐
8. If “present” to Q15, specify _____
9. Maturity data:
 - a. Crown-ramp length (cm): _____
 - b. Crown-heel length (cm): _____
 - c. Head circumference (cm): _____
 - d. Weight (Kg): _____
 - e. Other(specify)_____
10. Degree of maturity based on Q18: Term ☐ Preterm ☐
11. Umbilical cord condition
 - a. Tied ☐ Torn ☐ Attached to placenta ☐
 - b. Hospital cord tie attached ☐
 - c. Clean cut or ragged ☐
12. Postmortem changes
 - a. Putrefaction: Present ☐ Absent ☐
 - b. Maceration: Present ☐ Absent ☐
13. Is the Cause of death determined? Yes ☐ No ☐

14. If "Yes" to Q21, what is the cause determined?

- a. Suffocation ☐
- b. Strangulation ☐
- c. Gagging ☐
- d. Drowning ☐
- e. Head injury ☐
- f. Spinal injury ☐
- g. Chest injury ☐
- h. Poisoning ☐
- i. Other (Specify) _____

15. Is an act of omission/ Neglect suspected or identified? Yes ☐ No ☐

16. If "yes" to Q23, what is the omission acted?

- a. Omission to tie the cord ☐
- b. Omission to protect the child from cold and heat ☐
- c. Omission to provide appropriate feeding ☐
- d. Other (Specify) _____

17. Postmortem interval:

- a. < 12 hours ☐
- b. 12-24 hours ☐
- c. 24-36 hours ☐
- d. 36-72 hours ☐
- e. > 72 hours ☐