

Child Death Investigations: An Analysis of Child Development and Recommendations
for a Best Practices Model for Post-Mortem Examinations

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Child Death Investigations: An Analysis of Child Development and Recommendations
for a Best Practices Model for Post-Mortem Examinations

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Abstract

Death investigations are a complex process that do not receive as much research and attention as other aspects of the criminal justice system. Medical Examiner and Coroner offices around the country have an important job: determining cause and manner of death in decedents. Death investigations go hand in hand with criminal investigations and our healthcare systems, yet are often looked over by other professionals and the public alike. Within the field of death investigations is a topic even more under researched, child death investigations. Child death investigations are a rare occurrence but more than ever emphasize the need for effective death investigation processes. Examining the existing death investigation protocols and building upon them based on scientific research and data can help shine a light on such a dark topic, and ensure our medicolegal systems are providing the best investigative work for victims and their families to allow them to have justice.

Keywords: death investigation, autopsy, procedure, infant, child development

TABLE OF CONTENTS

APPROVAL PAGE.....	1
TITLE PAGE.....	2
ACKNOWLEDGEMENTS.....	3
ABSTRACT.....	4
TABLE OF CONTENTS.....	5
I. Introduction.....	7
A. Statement of the Problem.....	7
i. There is a need for standardization in guidelines to conduct child death investigations and autopsies to identify remains and determine cause and manner of death more effectively.	
B. Purpose of the Study.....	9
i. To highlight the importance of human development in death investigations and create a best-practices recommendation for conducting pediatric autopsies to be taught to death investigators.	
C. Significance of the Study.....	10
i. There are no federal standards for child death investigations and autopsies, therefore creating a best-practices guideline may be effective in improving investigations techniques. Additionally, training investigators on child development can give more insight on possible causes and manners of death.	
II. Literature Review.....	10
A. Human Anatomy and Development.....	11
i. Infants	
ii. Children	
B. Death Investigations.....	12
i. General Guidelines	
ii. Special Considerations for Infants and Children	
C. Autopsies.....	17
i. General Guidelines	
ii. Special Considerations for Infants and Children	
III. Program Evaluation: Current Examples of Pediatric Death Investigations, Autopsy Protocols, and Death Investigation Training Curriculum.....	19

A. Center for Disease Control and Prevention.....	19
B. DC Office of the Chief Medical Examiner.....	21
C. New York State Department of Health.....	23
D. Royal College of Pathologists.....	24
E. Death Investigation Training Academy.....	25
F. American Board of Medicolegal Death Investigators.....	25
IV. Recommendations.....	26
A. Pediatric Scene Investigation Standard Protocol.....	26
B. Pediatric Autopsy Standard Protocol.....	28
C. Training Curriculum for Death Investigators.....	29
V. Conclusion.....	30
A. Limitations.....	31
B. Future Research.....	32
VI. Reference List.....	34

Introduction

Statement of the Problem

Post-mortem examinations are conducted by forensic pathologists with the help of medicolegal death investigators to identify remains and determine cause and manner of death in decedents. Medicolegal investigators respond to scenes with a reported death to investigate the scene and conduct an external examination of the decedent. External examinations are done to look for obvious signs of injury or trauma to the body. If the death is believed to be a manner other than natural, such as accidental, suicide, or homicide, then generally the decedent will be taken to receive an autopsy. Autopsies are internal examinations of decedents conducted by forensic pathologists. Autopsies are done to examine all of the organs in the body including the brain, further examine any trauma or injuries, and quantify toxicology levels to make a final determination of the cause and manner of death (DC Office of the Chief Medical Examiner, n.d.).

Manner of death determinations have several ramifications, and it is important to ensure that they are as accurate as possible. The most serious consequence is in regards to the legal system. Manners of death that are ruled to be a homicide open up a major investigation to who committed the crime, impacting local law enforcement and the court system. Manners of death that are ruled to be an accident can also have legal consequences, especially with children, if the

parent or caregiver was acting in a negligent way which contributed to the death. Manner of death determinations can also have financial repercussions with insurance, with some life insurance policies preventing families from collecting benefits if the policyholder commits suicide, or paying families more if a policyholder death was determined to be accidental. Lastly, death certificates are collected to be used as data by politicians to advocate for policy changes and new pieces of legislation as well.

Since the majority of child deaths are not caused by a natural factor (Centers for Disease Control and Prevention, 2020), it is important for medical examiner and coroner offices to be able to accurately determine cause and manner of death in children. Children and infant deaths are significantly more rare than adult deaths, making investigators and pathologists less experienced on conducting child examinations. Postmortem child death investigations are also not standardized or performed consistently between different forensic pathologists, which can cause incorrect manner of death determinations (Laskey et al., 2008). This means that the same case can have different outcomes depending on the agency conducting the investigation and which doctor is conducting the autopsy. This leads to death investigations of children (age 18 and younger) having a higher likelihood of remaining unexplained after postmortem examinations (Fleming et al., 2020). This is especially true with infants and Sudden Infant Death Syndrome (SIDS), a diagnosis in which infants under one year of age die with no apparent cause. In 2019, there were 1,248 deaths with SIDS as the diagnosis in the United States, and another 1,178 infant deaths that had no known causes (Centers for Disease Control and Prevention, 2019).

Death investigations have only recently become standardized by the U.S. Department of Justice (2011), but these standards have been developed on a broad scale to be applied to victims

of all ages. There is a lack of standard and effective investigation practices for identifying remains and determining cause and manner of death of children. Much of the research into death investigation practices that exists today is in regards to death investigations of adults, but there is a lack of data regarding how children's age and physical/mental development impacts the investigative process differently than adults.

Understanding the proper postmortem investigation techniques and creating a best-practices guide should be a priority for medical examiner and coroner offices in the United States. Currently, there are no federal standards for pediatric autopsies that all states must adhere to, which means that every medical examiner agency conducts their postmortem examinations differently. To ensure effectiveness and accuracy, a best-practices guide for pediatric autopsies should be developed and taught to forensic pathologists and death investigators. Having standardization in pediatric autopsy practices can ensure that forensic pathologists are considering all possibilities available to identify remains and determine cause and manner of death properly.

Purpose of the Study

The purpose of the study is to analyze the challenges that medicolegal investigators face when conducting child death investigations, and create recommendations for best practices for external and internal examinations to identify remains and determine cause and manner of death. These recommendations will be based on anatomy and human development, since anatomy and physiology changes significantly throughout a person's lifetime and directly influence death investigations. In regards to identifying remains, contextual clues at scenes often help with age determination of victims. However, in cases such as unknown skeletonized remains and mass disasters, it is beneficial to know the ways to make accurate estimates by using just the remains

themselves (Alkass et al., 2010). In regards to manner of death determination, children may have no external trauma to their bodies at the time of death. This emphasizes the importance of conducting a thorough scene investigation by medicolegal investigators and thorough internal examination by forensic pathologists.

Significance of the Study

This research paper will argue that a best-practices guideline for pediatric autopsies should be developed. The strategy that will be used to support the research presented is through the examination of various death investigation and autopsy protocols around the United States. By researching previous studies and current guidelines on postmortem examinations, they can be cross-referenced to create a best-practices recommendation based on evidence found for a comprehensive death investigation for all ages.

It will also be argued that knowledge of human physical and cognitive development should be prioritized in investigator trainings for postmortem examinations. Infants and children go through rapid physical and cognitive changes as they age, and their level of development can directly affect their cause of death. Having knowledge on the common causes of death in children and how and why they occur will improve investigations by educating investigators on what to look for at a scene and the types of questions that should be asked. Therefore, increasing knowledge and trainings for investigators will increase the likelihood of victim identification and cause of death determination.

Literature Review

The following literature review is separated into three major sections. The first section being a discussion of human anatomy to describe the major stages of development from infants, children, and adults. The second section is a summary of the general death investigation

guidelines, and the special considerations that are used for infants and children. The third section is a summary of the general autopsy guidelines and the special considerations that are used for infants and children as well.

Human Anatomy and Development

As medicolegal investigators and forensic pathologists, it is important to understand the fact that infants and children have a different anatomies and levels of physical and cognitive development than adults do. Because children undergo constant growth and change to their anatomy and cognitive abilities, knowing when those changes occur can help during investigations and determining cause of death. By treating all death investigations the same regardless of a decedents age, it can hinder the investigation by not getting the most precise and accurate information available.

From birth to three months, newborns are completely reliant on those around them to care for them. They have poor motor skills and necks that cannot support their head. This makes their head wobbly and difficult to move on their own. Their hearing and vision are not developed either, with sensitivity to noise and lack of eye coordination (Mayo Clinic, 2020). By four months, infants are able to push up onto their elbows when they are on their stomach. They can begin to track items visually with improved eye muscle control. Infants may begin to use their hands, but do not have a firm grip and use more of a swiping motion. At six months infants are able to roll from their stomach to their back. They can also begin grasping objects, but not with their thumbs. At nine months infants can sit unsupported and begin to crawl. By year one infants can pull up to stand and walk while holding onto furniture or a person's hand, as well as balancing on their own (Medline Plus, n.d. 2).

Skeletal structures are also rapidly evolving throughout childhood. In the skull, infants are born with six separate cranial bones: frontal bone, occipital bone, two parietal bones, and two temporal bones. The bones are held together by tissues called sutures. The spaces between bones that remain open in infants are called “soft spots” which do not form together until age twelve to eighteen months. Having flexibility in the skull during infancy allows them to pass through the birth canal and for the brain to grow (Medline Plus, n.d. 1).

In children, their brains are constantly growing and changing. The brain reaches its biggest size between ages eleven and fourteen. While the brain is done growing, at this age range, it continues to mature. The brain does not finish developing until the mid-twenties. The prefrontal cortex, which is responsible for planning and impulse control, is the last brain region to mature. Adolescent brains are also more vulnerable to stress and mental health disorders such as anxiety, depression, bipolar disorder, and eating disorders (National Institute of Mental Health, 2020).

Death Investigations

In 2011, the United States Department of Justice released a death investigation guide for scene investigators which lists step-by-step tasks that are to be completed in a death investigation. This guide is the most recent guide developed by a federal agency to be used in medical examiner and coroner offices across the country as an outline to create their own policy and procedures. While this document is a general guide on death investigations, it does encompass a full range of information from preparation before the scene investigation to completing the investigation. The Medicolegal Death Investigation Guidelines are separated into six sections: investigative tools and equipment, arriving at the scene, documenting and

evaluating the scene, documenting and evaluating the body, establishing and recording, and completing the scene investigation (U.S. Department of Justice, 2011).

The section titled *Investigative Tools and Equipment* provides an extensive list of all of the items that are necessary to conduct a scene investigation. These items include gloves, body bags, paper bags, evidence tape, thermometer, camera, and more. This is not an exhaustive list, whereas some agencies may use additional items and other agencies might not use many of the pieces of equipment on the list. For example, portable stretchers are an important tool to carry decedents to a stretcher when they are in a location that a typical stretcher cannot reach, but portable stretchers are not included on this list. On the other hand, this list contains blood collection tubes, even though many agencies do not take samples for toxicology on scene and are only done at autopsy (U.S. Department of Justice, 2011).

The next section, *Arriving at the Scene*, contains subsections such as introduce and identify self and role, exercise scene safety, confirm or pronounce death, participate in scene briefing, conduct scene walk-through, establish chain of custody, and follow evidence collection laws. First, investigators should identify themselves to any emergency personnel and family on scene, and determine that law enforcement has secured the scene. The next step is to pronounce death, which must be done in order to establish medicolegal jurisdiction and begin the death investigation. Once death has been pronounced, investigators are to listen to law enforcement regarding the circumstances of the death and the extent of their investigation up to the arrival of the investigator. Following the briefing, investigators examine the scene as a whole to understand the environment and collect any fragile evidence that may be present (U.S. Department of Justice, 2011).

The third section, *Documenting and Evaluating the Scene*, discusses the proper way investigate the scene and record all pertinent information. The subsections include photograph scene, develop descriptive documentation of the scene, establish probable location of injury or illness, collect/inventory/safeguard property and evidence, and interview witnesses at the scene. Investigators are to take photographs and write notes of the scene and surrounding area to help establish the environment the decedent is in (U.S. Department of Justice, 2011). When evaluating the scene, investigators are looking for any evidence that could have contributed to a person's death and document it. Evidence can include any illicit drugs, alcohol, weapons, or prescription medication. While law enforcement takes custody of illicit drugs and weapons on scene, death investigators take custody of a decedent's prescription medication and count it to determine if it was being taken as prescribed.

The next section, *Documenting and Evaluating the Body*, includes photographing the body, conducting the external examination, preserving physical evidence on the body, establishing decedent identification, documenting post mortem changes, participate in scene debriefing, determine notification procedures, and ensure security of remains. Photographs of the body are taken to document the condition of the body and if the body has any injuries or other trauma. Three major postmortem changes that occur are rigor mortis (stiffening of the body), livor mortis (settling of blood on the body), and algor mortis (change of body temperature to the temperature of the environment), all of which are documented in photographs as well. There are extra precautions taken in regards to evidence collection in homicides as well. Bodies are wrapped in an evidence recovery sheet before they are placed in the body bag, as well as having both hands and feet bagged individually to catch any trace evidence that may be lost. Once the decedent has been secured, they are transported out of the scene and the remainder of

investigation takes place from the medical examiner/coroner's office (U.S. Department of Justice, 2011).

The fifth section, *Establishing and Recording Decedent Profile Information*, discusses steps such as documenting the discovery history, determining terminal episode history, and documenting decedent medical, mental health, and social history. Medical records are gathered and examined to see if the decedent had any prior medical conditions, accidents, or mental health diagnoses that could have contributed to their death. Medication lists are also acquired for each decedent to determine if they were used appropriately, and determine if they were prescribed if a prescription medication is found in a patient's toxicology report. Social history such as alcohol, tobacco, and illicit drug use is important to gather too from medical staff and family members to determine if the substances could have contributed to the death as well (U.S. Department of Justice, 2011).

The last section, *Completing the Scene Investigation*, outlines the final steps needed to finish an investigation. These steps include maintaining jurisdiction over the body, releasing jurisdiction of the body, performing exit procedures, and assisting the family. Investigators are responsible for maintaining jurisdiction over the body while it is in storage and arranging transport for autopsies. Once a death certificate has been signed investigators can then release the body to the chosen funeral home. The last step comes from informing the families about the status of the investigation, and sharing autopsy and toxicology reports as they are finalized (U.S. Department of Justice, 2011).

While the guide from the Department of Justice (2011) gives a thorough description of the death investigation process, it was developed to be applied to all cases, and does not go in to detail about any special circumstances. There are special considerations that have to be taken

during a death investigation for an infant or child that do not apply to adults. Some of the major considerations investigators have to be aware of are doll reenactments, mother's medical history, and contact with the school.

One of the considerations in infant cases is conducting a doll reenactment. A doll reenactment is done to show the position the baby was in before and after death. There are four steps to the doll reenactment: explaining the reenactment to the family member or caregiver, have the placer/finder of the infant place the doll in the infant positions, photograph reenactment, and debrief family member or caregiver (Diebold, n.d.). Because many people are not descriptive enough to verbally say how the infant was found, it is helpful to have a visual representation of the infant at the scene. The reenactment is done with the person who initially found the infant unresponsive, who can then show the position they were placed in before the death and the position they were in after they were found. Doll reenactments show the infants body position, head and neck position, and anything around the body that could have contributed to the death such as improper bedding obstructing the airway. Doll reenactments are not only important for investigators on scene, but for forensic pathologists who are not on scene and have to rely on photographs (Diebold, n.d.)

Another special consideration in infant death investigations is obtaining medical information from the mother. While in any other circumstance, medicolegal investigators are unable to get medical information from those who are living, in infant deaths, looking at the moms medical history while she was pregnant can show any conditions that could have contributed to the death. Information from the mother can include if she had any prenatal care, if she had any injuries or complications during the pregnancy, and if the mother used any

medications, alcohol, tobacco, or illicit drugs during her pregnancy (Centers for Disease Control and Prevention, n.d.).

Lastly, in child deaths it is important to reach out and get information from the child's school. Especially in cases of suicide, it is important to know if there were any triggers at school that the parents were unaware of. Talking to teachers and other students to see how their grades were, if they had any relationships, or if they were bullied can help better understand the circumstances around the death.

Autopsies

Autopsies are conducted by forensic pathologists as an internal examination to make a final determination on cause and manner of death (DC Office of the Chief Medical Examiner, n.d.). State laws and medical examiner/coroner policies dictate which deaths are brought in for autopsy, and which deaths only get an external examination at the scene by the medicolegal investigator, and can therefore be released to a funeral home on scene. Some counties bring in almost every decedent for an autopsy if their death was not undeniably natural, while other counties only autopsy suspected homicides.

There are three major types of autopsies: external examinations, complete autopsies, and partial autopsies. In all types of autopsies, the decedent is photographed thoroughly and all findings are recorded for the final autopsy report (DC Office of the Chief Medical Examiner, 2015). Toxicology is also conducted at most autopsies to determine what, if any, illicit drugs, alcohol, prescription medications, or other substances were in the body that could have contributed to the death. Toxicology can be drawn from three parts of the body: urine, blood, and vitreous fluid found in the globe of the eye. The method used depends on the circumstances of the case. Urine is most convenient to test, but is the least accurate because substances in the urine

metabolize the quickest. Chemicals in the blood metabolize slower than urine, and chemicals in vitreous fluid metabolize slower than blood. Vitreous fluid also resists decomposition longer than blood and urine (Collins, 2019). Testing all three methods if possible is the most reliable because the presence of a substance in one but not the other can indicate a timeline in which the substances entered the body.

External examinations are a detailed description of the decedent's body, including condition of the body, any scars, tattoos, medical devices, previous surgical interventions, etc. No incisions are made to the body and the organs are not examined (DC Office of the Chief Medical Examiner, 2015). An example of a case that would require an external examination only is a person who died of a drug overdose, and had illicit drugs on scene near the body. In an overdose, there is no internal trauma to the body that would require an internal examination, thus requiring only an external examination (looking for things such as "track marks"--injection marks on the body consistent with intravenous drug use) and study of toxicology to determine the cause of death.

Complete autopsies are detailed external examinations of the body, as well as an internal examination. Internal examinations consist of removal and dissection of all thoraco-abdominal and neck organs, and opening the skull and examining the brain (DC Office of the Chief Medical Examiner, 2015). Histology is also done with tissues in the body to determine if there are any diseases present. An example of a case that would require a full autopsy is a fire death. A full autopsy would need to be conducted to look at the internal structures and determine if the death was from a heart attack due to the stress of the fire, smoke inhalation, or even strangulation with the fire being set postmortem to eliminate evidence.

Lastly, partial autopsies are completed when there is a danger to autopsy personnel, such as the decedent had some sort of infection or chemical exposure, a religious objection to a full autopsy, or to retrieve any evidence (DC Office of the Chief Medical Examiner, 2015). An example of a case that would only require a partial autopsy is a self-inflicted gunshot wound to the head. It is apparent that a gunshot wound would be damaging enough to cause death so there is no need to examine the rest of the body, but the forensic pathologist has to remove the bullet and any fragmentation left in the skull.

In most jurisdictions, all infant and children deaths require a full autopsy (DC Office of the Chief Medical Examiner, 2015). Since these deaths are so rare, it is important to investigate them to the fullest extent. Especially in regards to infants, Sudden Infant Death Syndrome and other unexplained circumstances can cause death that do not apply to adults. Reviewing medical records is a major part of conducting a death investigation, and because children are young, many have very little medical history. This emphasizes the need to use other methods such as a full autopsy to determine cause of death.

Program Evaluations: Current Examples of Pediatric Death Investigation and Autopsy Protocols

Every county in every state has its own protocol for conducting child death investigations and postmortem examinations. However, these protocols are not standardized and vary greatly between jurisdictions. Lacking a standardization in death investigation practices and post-mortem evaluations allows for important tests and observations to be missed, and can lead to undetermined or even incorrect manner of death determinations.

Centers for Disease Control and Prevention

The Centers for Disease Control and Prevention (2007) is a federal agency that has released a best practices guide on investigating sudden, unexplained infant deaths. This guide has six sections: investigative tools and equipment, arriving at the scene, documenting and evaluating the scene, documenting and evaluating the body, establishing infant profile history, and completing scene investigation.

The first aspect in the investigation to consider is the scene. Many times, there will be an emergency medical service response and infants will be transported to the hospital following a death. If that is the case, not only should investigators respond to the hospital and investigate that scene, but should also investigate the scene where the incident occurred, whether that be the home, daycare, vehicle, etc. All locations of the infant in the last twenty-four hours should be recorded as well as the post-discovery activity such as moving the body, transporting to the hospital personally as opposed to via ambulance, etc. On the primary scene with the decedent, a full body examination along with photography should be conducted. Clothing should be photographed and collected as well. Full body examinations of the decedent occur on scene and include documenting the infants physical characteristics, condition of clothing, rashes/marks/scars, presence of injury or trauma, and medical treatment/resuscitative efforts (Centers for Disease Control and Prevention, 2007).

At the incident scene, there are several aspects that should be documented, both in writing and in photographs. These include examining the general appearance/state of the interior and exterior of the building or vehicle, determining if it is clean, spacious, messy, dirty, unkept, or even hoarded. Looking at various items in the house can also give an idea of the family and infants lifestyle. Noting the presence of any weapons, tobacco, alcohol, illicit drugs, drug paraphernalia, or prescription drugs, as well as presence or absence of any baby supplies such as

formula, bottles, baby food, diapers, etc. can indicate the how well cared for the infant was and what they possibly could have been exposed to. The sleep environment (if applicable) is another important aspect of the scene that needs to be thoroughly documented. This includes noting if they were in a bassinet, crib, adult bed, etc., layers of bedding on the bed, and any items on the bed. The DC Office of the Chief Medical Examiner (2015) also recommends collecting the bedding as evidence for forensic testing.

Interviews are another important aspect of the investigation. The most important interviews are with the “placer” and “finder” of the infant (sometimes the same person). Determining the position they were placed in before death and comparing it to the position they were found deceased in can indicate possible ways for death to occur. Interviews of the family on scene should be done separate from each other to determine if there are any discrepancies. During these interviews important information to note includes typical routines and any deviation from that routine, as well as their time last known alive. At this time a doll reenactment should be conducted to visualize and document the placement of the head, neck, nose, and mouth before and after death (Centers for Disease Control and Prevention, 2007). Questions should also be asked to any medical personnel on scene, as well as requesting medical records to further understand the decedents medical history. Things to review include prenatal history, birth history, exposure to drug or alcohol abuse during pregnancy, sudden illnesses that began within the past twenty-four hours, medications, and vaccinations (Centers for Disease Control and Prevention, 2007).

District of Columbia Office of the Chief Medical Examiner

The DC Office of the Chief Medical Examiner has a thorough standard operating procedure to use as a guide for pediatric autopsies. The first step prior to autopsy is taking a full

body x-ray including anterior, posterior, and lateral views of the body. Photographs are then taken to record any injury or other anomaly. In cases of suspected child abuse, there are photos documenting the skin, eyes, mouth, neck, genitalia, hands, and feet. Babies and especially young children may have bruises on bony parts of their bodies such as forearms or knees, from moving around and bumping into things. However, if there is bruising on soft areas of the body such as stomach, cheeks, or calves, it can indicate physical abuse (DC Office of the Chief Medical Examiner, 2018b).

Measurements to be taken at autopsy include height, head circumference, chest circumference, abdominal circumference, as well as body weight. Several specimens are collected for microbiology testing to determine if there was any infection, and for toxicology to determine what chemicals are present in the body. Toxicology is especially important in the death of breastfeeding babies, as breastmilk is an easy way for things such as prescription or illicit drugs to be passed from the mom to the infant and cause death (DC Office of the Chief Medical Examiner, 2018b).

Most often infants and children that are deceased are with family or other caregivers and can be easily identified. However, there are times in which unidentified remains will be found and the medical examiner/coroner's office will have to work to identify who the decedent is. Besides visual and external identification by those who knew the decedent, there are four other methods of identification: fingerprints, radiograph comparison, circumstantial identification, and DNA comparison. Many infants have not had their fingerprints taken, but footprints to match to a birth certificate can aid in identification. Radiograph comparison with local hospitals can only occur if the decedent had x-rays done while they were alive, which many children and infants have not had. Circumstantial identification can occur only if there is someone who is suspected

to be the decedent. A biological profile from the decedent, a biological profile from the person suspected to be decedent, as well as circumstantial evidence are all presented to the medical examiner to make their final decision on identification. Circumstantial evidence can include date individual last seen alive, state of decomposition, location decedent was discovered, etc. Identification via DNA comparison is pursued if every other method of identification is unavailable. A family reference sample is collected as well as a sample from the decedent, and both are compared to determine if the samples are related (DC Office of the Chief Medical Examiner, 2018a).

New York State Department of Health

The New York State Department of Health Infant Autopsy Protocol is a document similar to that of the DC Office of the Chief Medical Examiner's Office, but involves more in-depth studies and testing. Routing studies include photographs, full body x-rays, toxicology, histopathology, neuropathology, and metabolic screening. Histopathology is the examination of tissues at a microscopic level, and neuropathology is the examination of the brain and spinal cord, both to determine if there are any diseases present. Metabolic screening is the examination for any metabolic diseases present such as diabetes, heart disease, and cirrhosis (New York State Department of Health, n.d.).

Other studies conducted as needed include glucose screening, microbiology/virology, genetic studies, electrolyte levels, and HIV testing. Glucose screening is conducted to determine glucose levels, which can be used to potentially diagnose someone with diabetes if someone was not already diagnosed. Microbiology and virology are used to diagnose any infection within the body. Genetic studies are conducted to determine if themselves or any relatives are at risk for a genetic disease or sudden death. Electrolyte levels can determine if there is proper kidney

function within the body. Lastly, HIV testing can determine if someone is at risk or has acquired immunodeficiency syndrome (AIDS) which can lead to death (New York State Department of Health, n.d.).

External examinations in this Infant Autopsy Protocol have a focus on postmortem changes, general appearance and development, injuries, therapeutic procedures, and evidence of any medical intervention. Internal examinations are conducted on the head, neck, body cavities, and all of the systems in the body including cardiovascular, respiratory, hemolymphatic, genitourinary, endocrine, digestive, and musculoskeletal systems. The New York State Department of Health also requires more information on the medical history of not only the infant and mother, but siblings as well. Determining if a sibling or other relative has had Sudden Infant Death Syndrome can indicate that the decedent was predisposed to having it (New York State Department of Health, n. d).

Royal College of Pathologists

The Royal College of Pathologists based out of London, England has developed a best practices guide specifically for studying brain pathology at autopsy. While many infants and children can die from Shaken Baby Syndrome or other forms of abuse or accidents, it is important to understand what a traumatic head injury looks like to diagnose at autopsy. There are several kinds of pathologies that can present themselves during autopsy, first is in the scalp. Forensic pathologists should note the distribution of any present lacerations or bruising in relation to the rest of the face, as well as surgical incisions or scars indicating a neurological intervention. The skull is another important aspect to look at, as skull fractures are common in traumatic head injuries. Hematomas are a pooling of blood outside of the blood vessel, which when seen in the head, can indicate traumatic brain injury. Extradural hematomas occur in the

space between the skull and the outer protective lining covering the brain called the dura mater. Subdural hematomas occur between the dura mater and the brain. Swelling in the brain is another injury that can be fatal that should be noted during autopsy via visual inspection, size measurement, and weight. When examining the brain it is also important to be informed of the decedent's medical history such as previous head injuries, blood clotting disorders, and any neurological interventions conducted by paramedics or hospital staff. The brain stem and spinal cord are also sampled and examined for possible injury, such as diffuse axonal injury, in which the brains connecting nerve fibers are torn following the brain shifting within the skull (Smith et al., 2010).

Death Investigation Training Academy

Hiring requirements and training curriculum for medicolegal investigators vary by county and agency. There is no standard on training curriculum for new investigators. Many agencies require work experiences in the criminal justice system or healthcare field to be considered for the job. There are many independent online courses as well as colleges that have week-long programs on death investigation in which students can receive certifications prior to beginning a medicolegal investigator career.

The Death Investigation Training Academy is an organization that provides training to participants specifically on the topic of death investigation. They provide online and virtual classes on a variety of aspects in a death investigations, including scene management, ethics, courtroom testimony, cause and manner of death, wound identification, osteology, and suicides. Training on infant and child death investigations is mentioned only briefly in their training academy (Death Investigation Training Academy, n.d.).

American Board of Medicolegal Death Investigators

The American Board of Medicolegal Death Investigators (ABMDI) is an independent professional certification board for medicolegal death investigators. The ABMDI uses the *Death Investigation: A Guide for the Scene Investigator* (Department of Justice, 2011) as a guide to certify individuals for displaying the knowledge and skills necessary for medicolegal death investigations. There are two kinds of certification: basic certification and board certification. For the basic certification applicants must be working as a medicolegal investigator and have certain numbers of types of cases investigated in order to take the test and be certified. While the ABMDI does not train investigators upon hire, it does serve as a benchmark of knowledge and experience for investigators to try to achieve (American Board of Medicolegal Death Investigators, n.d.).

Recommendations

Recommendations for ideal pediatric death investigations and investigator training curriculum has been compiled based on findings from the literature review and program evaluations previously discussed in this research paper. These ideal component recommendations were developed using the most effective portions of previously evaluated programs and research studies to create recommendations to improve child scene investigations and autopsies. Suggestions for medicolegal investigator training content and strategies are also given based on the literature review and program evaluations to improve the quality of investigations for infant and child deaths.

Pediatric Scene Investigation Standard Protocol

Various components from the Centers for Disease Control (2007) and United States Department of Justice (2011) can be combined to create a best practices protocol for conducting scene investigations for child deaths. The successful aspects of each preexisting protocols can

help guide investigators to ensure they are conducting their investigations in a standardized way to be as thorough and accurate as possible. This best practices protocol should be a part of both new investigator training and in-service training for current investigators.

A pediatric scene investigation protocol should be divided into four sections:

Investigative tools and equipment, scene investigation, external body examination, establishing decedent profile, and completing the scene investigation. Investigative tools and equipment should be listed in two parts: scene bag items and transport vehicle items. Scene bags can fit much of the equipment needed to conduct a scene investigation, but not all. Examples of essential equipment in a scene bag includes latex gloves, camera, thermometer, tape measure, medication bags, evidence tape, and bag seals. Examples of other essential equipment includes a stretcher, body bags of all sizes, Tyvek suits, and baby dolls. Making one centralized list that all agencies can refer to for their own scene bags and transport vehicles helps investigators prepare for any type of scene.

The scene investigation gives the investigator context clues regarding how an infant or child died. All investigations should begin with a basic walk through to understand what the area looks like and the condition that it is in. Overall photos should be taken to document the scene as well. If there are primary and secondary scenes, such as a home and a hospital, both should be documented (Centers for Disease Control, 2007). Medicolegal investigators do not need to follow the same search laws that law enforcement does, and therefore can search the residence or surrounding area to find evidence that may impact the cause and manner of death. Medications should be counted and collected and any illicit drugs should be documented and turned over to law enforcement for disposal.

The external body examination is the preliminary examination of the body which provides the pathologist with basic information about the decedent before the autopsy occurs. Especially with infant and children, it is important to be very thorough. There are photographs taken of every part of the body, including head, torso, extremities, and airways (Center for Disease Control, 2007). All injuries and post mortem changes should be noted and photographed. Swabs are also taken from infants externally to show if there was any foreign DNA present of the decedents body.

The following step for investigators to follow is the establishment of the decedent profile. Gathering information on the decedent begins on scene and continues for the days to follow. Interviews with family and others on scene is very important to know the circumstances leading up to the death (United States Department of Justice, 2011). Learning medical history of both the child and the mother can also help determine if the decedent had any illnesses or was predisposed to any medical issues. On scene towards the end of the investigation is the doll reenactment with the involved parties, which acts as a visual guide to understand the positions they decedent was in which could have contributed to their death. Lastly, it is important to obtain reports and information from other agencies that were involved, including, police, paramedics, and hospital staff.

Pediatric Autopsy Standard Protocol

Components from the DC Office of the Chief Medical Examiner (2018b), New York State Department of Health (n.d.), and Royal College of Pathologists (Smith et al., 2010) have all been compiled to determine the most effective way to conduct pediatric autopsies. The successful aspects of the preexisting protocols act as a checklist for forensic pathologists to investigate a death to the best of their ability. This best practices protocol should be taught to not

only investigators, but forensic pathologists and autopsy technicians to ensure all infant and child autopsies are standardized.

Autopsies begin with external examinations, photographs, and x-rays. Toxicology and microbiology samples are drawn and submitted to the forensic laboratories for further quantified identification. Autopsies consist of a thorough examination of all internal structures in the body, which identifies any injury or disease present. Metabolic screening, histopathology, glucose screening, and genetic studies are other tests conducted to determine if there was any natural condition or disease present in the body that contributed to death (New York State Department of Health, n.d.).

One of the most important aspects of the child autopsy is the examination of the brain. Notable changes such as lacerations or bruises on the scalp, skull fractures, hematomas, and/or brain swelling can all be indications of traumatic brain injury in a child, as opposed to a natural death. Examining and sampling the brain stem and spinal cord are also needed to show further brain injuries (Smith et al., 2010).

Training Curriculum for Death Investigators

Much of the training curriculum for infant and child deaths is based around scene work. While conducting a thorough scene investigation in a very important aspect of the death investigation process, it is also important to understand relevant medical information for infant and child deaths as well. Understanding physical and cognitive development in children is essential to the death investigation job because their development can have a major impact on cause and manner of death.

Medicolegal Death Investigation hiring requirements and training varies from county to county. By having training curriculum for child deaths that is standardized will be a good

reference for investigators to study prior to child death scenes, as well as ensuring all child deaths are being investigated in the same way. Topics for training investigators on child death cases can include human physical development, human cognitive development, common health conditions in children, and common medical complications in pregnancy and birth. Special requirements for scenes that should also be included in the investigation trainings include how to conduct a doll reenactment and conducting interviews with parents and caregivers (Diebold, n.d.). In child death cases more often than adult death cases are criminal charges filed against a related party. It is important to know how to work effectively with law enforcement as a death investigation becomes a criminal investigation as well.

Conclusion

Medicolegal death investigation is a constantly evolving field with the potential to make substantial growth and advancements in regards to science and the criminal justice system. There is a lack of standardization in pediatric death investigations in the United States, which impacts cause and manner of death determinations in infants and children. While pediatric deaths are more rare than adult deaths, they are more likely to be ruled as undetermined at autopsy than adult deaths (Fleming et al., 2020). This prevents families and victims from learning the cause of what caused the death, and does not allow for education and prevention measures to be taken by other parents.

Through an extensive literature review, it can be concluded that there are many differences in the anatomy and physiology of infants and children compared to adults, such as skeletal structure, mobility, and cognitive development. These differences are important to consider during an investigation because it can directly impact the cause of death. The literature review can also establish the fact that there are special considerations to be aware of during a

pediatric death scene investigation and autopsy that do not apply to adults. These major considerations include conducting doll reenactments, obtaining the mother's medical history information, and conducting thorough interviews of associates. Many infant deaths do not have visual trauma, so it is crucial to gather as much contextual information as possible to try and determine what could have happened.

The ideal program components for pediatric scene investigations and autopsies can be an effective way to make more accurate cause and manner of death determinations. By implementing standards for investigations and autopsies, it can ensure that all pediatric deaths are being investigated to the fullest extent. Thorough photography and x-ray imaging, swabbing for DNA or biological information, and toxicology draws provide pathologists with more information on the decedent than that is visible during the autopsy.

Developing a standardized training curriculum for investigators can help increase and update the knowledge of people in the medicolegal field. Standardizing the training for investigators also means that the investigations themselves will become standardized as well to an extent, and the same type of information is going to be gathered each time. Increasing training will also improve medical knowledge in investigators, who are lacking in this area because investigators are trained mostly on scene work. The recommended ideal program components can be used as a building block for other agencies to develop their own protocols for investigations and training.

Limitations of the Research

A major limitation in the research of death investigations is that researchers cannot recreate death scenes and autopsies as an experiment inside of a laboratory. Researchers are at the mercy of the deaths that happen to occur in the area to be used in their research. On top of

waiting for deaths to occur to conduct the research, the deaths have to be of children, which occur much less frequently than adults. With death investigations occurring sporadically, they are also done with the utmost efficiency. While autopsies are scheduled so there is some room to allow for planning of research, death scenes are not. Scenes need to be processed and bodies need to be transported as quickly as possible and investigators cannot wait for a researcher to come to the scene before they can start. Because of this, much of the information compiled by researchers is secondhand information collected by medicolegal investigators and forensic pathologists.

Another limitation of the research is the lack of standardization in the medicolegal system as a whole. Medical examiner and coroner systems are both used and vary county by county. This means that staffing and levels of knowledge vary by county as well. There has been one federal standardized death investigation protocol, but none in regards to child death investigations. Cases may be investigated much more thoroughly in one county as opposed to another. This creates difficulty in research because there are several variables that need to be accounted for.

Recommendations for Future Research

In the future, it is recommended that more information be gathered on infant and child death investigations—specifically the aspects that are unique to them as opposed to adults. Researching what is necessary to be investigated at child death scenes can help make investigators more thorough and therefore give more context to the forensic pathologists when making death determinations. Examining results of various tests and samples collected during pediatric autopsies can also determine which is most accurate in determining cause and manner of death as well. This compiled research would be beneficial in creating and updating the death

investigation protocols and the training curriculum that accompany them. Further research on agencies with child death determinations that have lower percentages of undetermined deaths after implementation of a new death investigation protocol will determine whether or not the protocol is effective.

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