

Ann H. Ross
Suzanne M. Abel *Editors*

The Juvenile Skeleton in Forensic Abuse Investigations

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 Humana Press

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To Alex and Evelyn

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Chapter 1

Introduction

Ann H. Ross and Suzanne M. Abel

1.1 Homicides and Abductions of Children

According to the US Department of Health and Human Services, the Administration for Children and Families, in 2005, there were an estimated 1,460 fatalities due to child maltreatment [1]. Of these, 42.2% were as a result of neglect only, 24.1% were caused by physical abuse only, and 27.3% were caused by a combination of types. The remainder of deaths included sexual abuse, psychological abuse, medical neglect, and other unknown causes. Children younger than 4 years accounted for 76.6% of all maltreatment fatalities, with 41.9% of these deaths occurring in infants [1]. Child fatality rates per 100,000 children in the United States for years 2000–2005 are presented in Table 1.1. The data show a slight rising trend between 2000 and 2004 [2].

According to the Juvenile Justice Bulletin [3], in 1999, there were approximately 1,800 juvenile victims of homicide in the United States, which is substantially higher than in any other developed country. Data show that the homicide patterns for young children (<5 years of age), middle childhood (6–11 years of age), and teenagers (12–17 years of age) differ significantly and thus should be evaluated independently [3]. According to this report, most homicides of young children are committed by family members and may be significantly undercounted. During the past 30 years, homicide is the only cause of childhood death that has increased in incidence (homicides of infants and children [0–4 years of age] have risen 50% [4]), while other major causes of death such as congenital abnormalities, accidents, and infectious disease have dropped [3]. According to the US Census Bureau [5], homicide is ranked second, third, or (depending on the specific age group) among the top four causes of childhood mortality. Significantly, more children die of homicide in the 0–4 age group than of infectious disease or cancer.

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Table 1.1 Child fatality rates per 100,000 children, USA, 2000–2005

Reporting year	Number of child fatalities	Rate per 100,000 children	Estimated child fatalities
2000	1,306	1.84	1,330
2001	1,373	1.96	1,420
2002	1,397	1.99	1,450
2003	1,317	1.92	1,400
2004	1,386	2.03	1,490
2005	1,371	1.96	1,460

Adapted from Child Maltreatment (2004, 2005)

According to the NC Child Fatality Prevention Team 2007 report [6], 65 children were victims of homicide, with the majority or 43% being teens (aged 15–17 years), followed by infants (20%), 1–4-year-olds (15%), 10–14-year-olds (15%), and 5–9-year-olds (6%). Ross et al. [7] found that the peak age-at-death categories were 0–3 months (25%) and 2–6 years (19%), which could reflect newborn stress and coincide developmentally with independent stages, respectively. Toddlers were found to be particularly vulnerable to evoking hostile care from their parents during this developmental phase when they show defiance and self-assertiveness in their attempts to seek autonomy [8]. Their results showed that boys were more likely to die of physical abuse than girls, coinciding with conclusions by Sobsey and coworkers [9], who found that more boys were physically abused than girls. A racial bias was also seen in the results. Chi-square tests for independence showed that not only significantly more ($p < 0.0001$) minority children are dying in North Carolina compared to white or European ancestry children, but also significantly more ($p < 0.0001$) minority children are dying as a result of specifically abusive causes [7].

1.2 Disposal and Discovery of Child Remains

In a 1996 FBI study [10], the disposal of the remains was found to be dependent on the age of the victim and the motivation of the perpetrator. Neonates (0–1 months of age) were found to be abducted for replacement reasons or the intent of keeping the child, and in 79% of these cases, the neonate was abducted by a female and was found alive [10, 11]. The remaining 21% were killed for emotional reasons by their parents, of which 67% were disposed of within a 1–5 mile radius and the remaining 33% were disposed of in the residence [10, 11]. In the infant category (1–12 months of age), in 83% of the cases, children were killed for emotional reasons, typically by their biological parents in the residence and disposed of within 5 miles. In the remaining 17% of the cases, the infants were disposed of 5–10 miles from the residence [10, 11]. Toddlers (13–36 months) were primarily killed by a family member (82%) for emotional reasons (90%) and disposed of within 1 mile in 56% of the cases and within 1–5 miles in 22% of the cases. For preschoolers (3–5 years of age), the motivation was divided between emotional based in 54% of the cases, sex based

in 30%, and profit based in 16%. In all motivation categories, the victims were disposed of within 100 yards of the offense site in 58% of the cases, within 5–10 miles in 17% of the cases, and within 10–30 miles in 30% of the cases [10, 11]. Generally, it was found that the younger the victim, the closer to the victim's residence the remains were discovered [12].

1.3 Purpose of the Book

These alarming statistics as well as a recent upsurge in media attention to all matters forensic has underscored the need for increased scientific attention and rigor in child abuse cases. The popularity of televised tracking of child abductions and fatalities in the United States has acted to give viewers an *entrée* to the deeper academic, investigative, and collective methodology of those involved in such casework. To address these matters, we have gathered a collection of topics that detail the finer points of investigations surrounding juvenile fatalities under the suspicion of child abuse.

The precise reason why many professionals enter this arena of investigation is, of course, personal and individual. However, at the core of our work is a shared need for simple justice. Victim advocacy and protection of rights of children, both living and deceased, remain a large impetus for those who specialize in child abuse research. This book aims to provide some level of agency, or purposeful voice, for those who cannot stand up and speak for themselves.

1.4 The Holistic Approach

Cases involving child abuse require a multidisciplinary investigative approach. Local law enforcement, death investigators, and crime scene specialists will be the first officials called to the scene. These individuals work closely with the coroner or medical examiner who is the legal authority and whose office acts as a hub to which a large group of consulting specialists will report their individual findings. Pathologists, forensic anthropologists, forensic odontologists, radiologists, and pediatricians work with or for the coroner/medical examiner to provide vital information on the physical status of the victim.

The chapters in this volume reflect this holistic approach as anthropologists and various personnel from medical examiner's and coroner's offices have contributed their individual professional input to juvenile death investigation.

Ragan (Chapter 2) opens with a concise historical timeline of child abuse and then introduces the complexity of determining an accurate incidence of child abuse and neglect. Humphries (Chapter 3) follows with an overview of juvenile skeletal anatomy and growth and development. Ubelaker and Montaperto (Chapter 4) discuss how biomechanical growth and remodeling processes in the juvenile skeleton differ from that found in the adult. They also discuss how knowledge of such

features can help reveal the nature and subsequent interpretation of juvenile trauma as well as the timing of fracture events. Continuing the discussion of trauma, Heldrich (Chapter 5) provides a clinical perspective in her discussion of the physical expression of birth trauma in the newborn. She also gives a list of differential diagnoses and conditions that lead to bone fragility. Abel (Chapter 6) underscores the importance of distinguishing between accidental and nonaccidental skeletal trauma, not only for the identification of individuals but also for the possible circumstances surrounding the death event. Schindell and O'Neal (Chapter 7) provide an applied approach to basic scene investigation procedures and discuss the application of these procedures in some of the unique situations commonly encountered in child death investigations, including shaken baby syndrome. Kimmerle and Chrostowski (Chapter 8) discuss the various medicolegal issues of battered baby syndrome through a case presentation. They also present some of the general trends among such cases that illustrate the difficulty in employing this syndrome as a diagnosis. Cardoso and Magalhães (Chapter 9) provide a detailed discussion on evidence of neglect from the assessment of growth differentials in immature human skeletal and dental structures. The authors offer two general approaches for the detection of growth failure from observations in bone and teeth. Ross (Chapter 10) presents a case study illustrating the utility of several biological indicators including bone mineral density in the medicolegal investigation of fatal starvation, a severe form of neglect. She underscores the importance of using multiple lines of evidence such as complete social, medical, and investigative history in order to rule on a cause and manner of death. Sutphin and Ross (Chapter 11) report on the estimation of stature for a juvenile Chilean population. Juvenile stature estimation can be particularly useful in the forensic setting, which may have applications for use as a proxy for nutritional health and possible neglect. Cunningham, Kirkland, and Ross (Chapter 12) provide the results of a short-term study utilizing pig carcasses as juvenile human proxies in order to study osteological decompositional changes occurring within a year in the central Piedmont region of North Carolina. Such taphonomical alterations in intrinsic and extrinsic bone architecture assist the investigator in determining postmortem interval for outdoor depositions of juvenile remains and have implications for the southeastern United States.

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Chapter 2

Fatal Child Maltreatment: The Challenges of Identifying the Causes and Incidence of Deaths from Abuse and Neglect

Krista L. Ragan

Abstract To many, it is almost unfathomable that a parent is capable of intentionally injuring or murdering their own child. However, history has shown us that abuse and murder of an offspring was acceptable under various conditions in many societies from ancient times through the 20th century. While the past is dotted with social and legal responses to child abuse, widespread interest and study of the topic did not truly begin until the early 1960s. Since that time, much effort has been devoted to determine what causes child abuse and neglect. While a good deal has been learned over the past 50 years, child maltreatment is still an ambiguous field of study. Even with our improved dedication to identifying and understanding the problem of child abuse and neglect, our knowledge of the issue is hampered by the complexity of the problem not only as it occurs but also in our ability to adequately measure the true incidence of child maltreatment.

My relationship with Mom drastically changed from discipline to punishment that grew out of control. It became so bad at times, I had no strength to crawl away – even if it meant saving my life.

Dave Pelzer; A Child Called It [1]

2.1 A Brief History of Child Maltreatment

Child maltreatment in its various forms is well documented throughout history as are child deaths, which were not unexpected due to the prevalence of illness, disease, and accidents. However, as far back as ancient times the first test for a newborn after surviving the trauma of childbirth was not disease, rather surviving their parents or the rules of society. Many cultures thought of infanticide as an acceptable means of keeping a family or society healthy or as a means of controlling the population [2–4]. Infanticide also occurred when the parents decided they did not want the child and they had the right to destroy their own property (as children were property at

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that time), when the child was illegitimate, or when the infant failed to pass a test of hardness [2, 3]. Of note, today, the term infanticide is applied only to infants under the age of 1 year [5], but prior to the 20th century, infanticide applied to children between the ages of birth and 7 years [2, 3].

In the Middle Ages, children were considered liabilities due to widespread poverty [4]. In the 16th and 17th centuries, it appears that children became valued for exploitive purposes. Children were sent to work in factories and mills, and sent into the streets as beggars and prostitutes to provide for their families. [2, 4]. The concept of neglect came into existence in the 18th century in England, mostly as the result of widespread alcohol abuse by parents and others [2].

During the time of the Industrial Revolution, child labor, poverty, and the working class grew [4, 6] as did child maltreatment. Children were still considered property of the parents, and the expectations of children included obedience, respect, and good behavior. It was felt that beatings were necessary to ensure that a child was morally sound, and severe physical punishment, short of death, was acceptable under the law [2]. At the same time, more emphasis was placed on education, and corporal punishment was utilized in schools [4]. It wasn't until the 19th century that change began to occur. Child labor laws were initiated; the family group, coming from communal living in the 17th century, was now an established societal unit; and concerns about the welfare of children increased as literary portrayals by several authors widened the spotlight on the treatment of children [2].

The recognition of the need to protect children was rather piecemeal over time, but has seen rapid growth over the last century and a half [6]. Though there was some attention paid by the courts and even a physician researching child abuse fatalities [3], one of the most recognized cases that led to change occurred in 1874 in New York City [2, 3, 6]. A woman, overhearing the screams of a child being abused, searched for assistance, only to find nothing could be done. The woman turned to an unlikely source, The New York Society for the Prevention of Cruelty to Animals. Arguing that if the child was being denied justice as a human, then the child should at least have the right of an animal not to be abused [2], and advocacy for child protection in the United States was born.

Change continued, as medical knowledge advanced rapidly and social and political action improved living conditions, education, and work opportunities. Child mortality rates declined considerably as a result. The fields of psychology and social sciences began to flourish, and with them the understanding of psychological and emotional development grew as well. These advances led to the recognition that the well-being of children was vital to the future [2]. Subsequently, the abuse and exploitation of children became less accepted socially, and work toward understanding and preventing child abuse began.

It was the seminal article entitled "The Battered-Child Syndrome" authored by Kempe, Silverman, Steele, Droegemueller, & Silver and published in the *Journal of the American Medical Association* in 1962 that has been credited as having the most significant impact on child abuse in professional settings and increasing public awareness of child abuse [3–5]. The article addressed child abuse through medical and psychiatric models [3]. The National Committee for Prevention of Child

Abuse reported that national polls in the mid-1970s showed that only 10% of the general population considered child abuse a serious problem, but 90% of the population started considering it a serious problem by the 1980s [7]. Today, hundreds of advocacy organizations exist across the world to advance children's rights. The United Nations Children's Fund (UNICEF) created the Convention on the Rights of the Child, a legally binding international agreement that specifically addresses in Article 19 the rights of the child to be kept safe from violence and abuse while in the custody of a parent or caregiver [8]. Research and investigation into child abuse and neglect are routinely conducted in a variety of fields including but not limited to psychology, medicine, sociology, and anthropology. And in many countries and almost every state in the United States, child death review teams have been created, charged with reviewing actual child death cases, mainly those due to abuse and/or neglect, and to identify how to prevent similar deaths in the future.

2.2 Child Maltreatment

2.2.1 Incidence

Child maltreatment is recognized as a complex global problem. The estimates of the incidence of maltreatment vary. The World Health Organization (WHO) reports that approximately 31,000 children under the age of 15 years are victims of homicide every year, and international studies have found that 25–50% of children reported being physically abused [9]. In the United States, the National Child Abuse and Neglect Data System (NCANDS) estimated that 772,000 million children were victims of maltreatment in 2008 [10] and that approximately 1,740 children died as a result of child maltreatment that year [11]. However, these numbers do not accurately reflect the actual incidence of child maltreatment, and the number of children who die from child abuse and neglect, in the United States and worldwide, is unknown [9, 12]. Many factors are cited in creating the challenges of understanding, classifying, and measuring child maltreatment, including the definition of child maltreatment [3–6, 9, 12, 13], the country reporting the maltreatment [9], the types of maltreatment being studied, and the types and quality of the research [5, 9, 12].

2.2.2 Definitions

One of the greatest difficulties in studying the causes of child abuse and neglect is a lack of a strong and consistent definition of what actually constitutes the broadest and most recent terminology, child maltreatment. Much of the literature expounds upon this hindrance [3–5, 9, 12, 13]. Bartol proffered that terms and concepts are often broad and ambiguous with inconsistent application in the field of family violence (which includes child abuse) [5]. Steele's appraisal of child maltreatment concludes that human behavior involves traumatic interactions between a child and a parent, caregiver, or stranger [14].

Even global organizations and governments have not agreed upon a common definition. The WHO [9] defines child (under the age of 18 years) maltreatment as

all types of physical and/or emotional ill-treatment, sexual abuse, neglect, negligence and commercial or other exploitation, which results in actual or potential harm to the child's health, survival, development or dignity in the context of a relationship of responsibility, trust or power. Exposure to intimate partner violence is also sometimes included as a form of child maltreatment.

In the United States, the Child Abuse Prevention and Treatment Act (as amended in 2003) defines the minimum standard of child maltreatment as

Any recent act or failure to act on the part of a parent or caretaker which results in death, serious physical or emotional harm, sexual abuse or exploitation; or, an act or failure to act which presents an imminent risk of serious harm.

Furthermore, the above definition is only the minimum set forth by the federal government; each state is able to create its own definition of child abuse and neglect based on these minimum standards [15].

2.2.3 Fatal Child Maltreatment

Some may expect that a death from child maltreatment should be rather obvious. The mention of "Child Abuse Homicide" brings to mind injuries such as head trauma and rib fractures, but the deaths that fall into this category are much broader. Researchers cite similar issues in fatal and nonfatal child maltreatment but add that the process of correctly identifying fatal child maltreatment suffers from variations in death investigations, differences among child death review processes, and limited coding options for child deaths through the International Classification of Disease (ICD) codes [12]. Scott et al. [16] also suggest that death certificate data underestimate the number of abuse-related deaths from 55 to 90%, depending on the study [16].

The issues of classification of fatal child maltreatment are broad. Some assert that the numbers of maltreatment fatalities are underestimated because the deaths are incorrectly attributed to falls, drowning, or other causes [9]. Other issues with identifying the role of maltreatment in a death may be that fatal child maltreatment may be a result of chronic abuse over time or may involve a single impulsive or planned incident [12]. It can be a direct result of a caregiver's action, or a result of the caregiver's failure to act. The neglect may be chronic or acute. Neglect to the point of a death being certified as a homicide may include starvation but may also include improper supervision so irresponsible that death could be an expected result, such as leaving an infant unattended in a bathtub for 30 min. National data for the United States found that 40% of the child maltreatment deaths were caused by multiple forms of maltreatment with neglect accounting for over 30% and physical abuse for over 20% of the deaths [11].

Returning to the issue of definitions, NCANDS defines "child fatality" as the death of a child caused by an injury resulting from abuse or neglect, or where abuse

or neglect was a contributing factor [12]. This in itself is confusing as the word “fatal” can be defined as “causing death” [17] (not specifically by maltreatment) and “child” is generally accepted to mean a human between the ages of birth and 18 years. Therefore, child fatality means the death of a person under the age of 18 years, which includes deaths from disease, drowning, and other means that may or may not be related to child abuse or neglect.

As noted earlier, studies have found that classification of deaths by using ICD codes on death certificates greatly underestimates the number of deaths due to maltreatment [12, 16, 18] because the deaths are incorrectly attributed to things such as drowning or falls, not neglect or abuse. However, it should be noted that the purpose of the death certificate is to record the actual mechanism or disease process that caused the death and the manner in which the death has occurred. The standard manners of death in the field of forensic pathology are accident, homicide, suicide, natural, and undetermined [19]. These classifications are to indicate how the death came about. For instance, in a firearm fatality, the cause of death would be a gunshot wound, however the manner of death could be categorized as accident (a 2-year-old shoots himself in the head), suicide (a teen distraught over sexual abuse shoots herself), or homicide (a father shoots his children so the mother cannot have them after she is granted custody by the court). In the above examples, the role of the pathologist is to determine (1) whether or not it was the gunshot wound that killed the person and (2) whether the death was the result of the decedent’s actions (and knowledge of potential injury) or the actions of another person. If you look closely, all cases could be attributed to child maltreatment. The first is a toddler having access to a firearm, the second could be a child who did not receive much needed mental health services, and the third is the parent taking the life of the child. The role of a pathologist or medical examiner is to determine the cause and manner of death, sorting out the role of neglect or the relationship of the person who inflicted an injury generally falls to the other entities involved in the investigation of a death or to a review team who takes a more in-depth examination of the life and death of the child.

For example, in North Carolina, the State Child Fatality Prevention Team (CFPT) reviews all medical examiner cases, which include accidents, homicides, suicides, deaths in undetermined manner, and deaths that were sudden and unexpected. In the course of a review, maltreatment is assigned as a contributing or causal factor in the death. In cases of homicides, the State Team utilizes the term “Homicide by Parent or Caregiver” [20]. The data are included in national child abuse numbers, but the deaths are examined in a way to determine what factors were involved, as deaths may be classified as maltreatment, but preventing an intentional asphyxiation death of a colicky infant is very different than a man who kills his children as a means of inflicting the ultimate pain on his ex-wife.

Data showing the number of deaths from maltreatment in the United States is woefully inadequate, not just because of the lack of a definition but also due to the sources of information. The Every Child Matters Education Fund report on child maltreatment fatalities reported 26 children had died from abuse and neglect in North Carolina between 2001 and 2007 [21]. Examination of the NC CFPT reports

for 2005 [20] and 2007 [22] showed that this 8-year total was equivalent to the 3-year *average* of homicides by parent or caregiver for the state. As the NC CFPT reports also indicate over 100 classifications of contributory neglect each year, one could assert that the national data sources underreport the magnitude of fatalities from child maltreatment.

2.2.4 Factors in Child Maltreatment

As difficult as child maltreatment and maltreatment deaths are to define and measure, the determination of what causes abuse and neglect seems more complex. Child maltreatment is an issue that cuts across the fields of medicine, sociology, law, psychology, child development, religion, psychiatry, biology, and anthropology [14]. Researchers maintain that no single factor or set of factors have been identified as causing child maltreatment [23] and that child maltreatment occurs through a number of complex processes in multiple contexts [7, 14, 23–25]. Initial studies were noted to be psychiatric in nature, focusing on parent psychopathology [3, 4, 26]. Zigler and Hall [4] warn that this view has been discouraged by studies that indicate that only a small fraction of abusers are mentally ill and that it is a dangerous theory as it purports that all mentally ill are potential child abusers [4]. More recent research trends toward ecological or social–ecological models. These models conclude that child maltreatment is a result of complex interactions between the child, parents, family, and society [4, 13, 23–26].

The recent economic conditions provide the setting for an example of this model:

A child is born prematurely into a family with 3 other children. This child has additional needs and the medical bills are mounting. Due to the economy, the father loses his job. He is now at home, bringing in a fraction of his income from unemployment. The unemployment rates are high, and the father, who has been working since he was a teenager, has not been able to find a job in 6 months and is now questioning his worth as an employee and a provider. The family who now has no insurance, turned to a community agency to get the developmental services needed for their infant and Medicaid for the other children. The community agency provides those programs based on funds from the state. The federal government cuts funding to the states, the states cut funding to the communities. The family loses access to the services and assistance needed for their children. Now the father cannot find a job, cannot provide for his family, is at home with a child with special needs who is not getting the necessary services.

This example is used to illustrate the interrelationships of the factors that may affect child maltreatment. Both neglect and physical abuse could be produced under these circumstances, but as others have noted, we must be wary of applying information obtained through research to individual cases. Several caveats were found throughout the literature (aside from the lack of a definition) regarding the available data on child maltreatment. Researchers acknowledge that the variables and characteristics identified in child maltreatment are done so in aggregate and may not be indicative of abuse in individual cases [13, 23]. Additionally, the need for more research is prominent, from longitudinal studies [13, 26], to broader populations [26], to developmental stages in relationship to the types of abuse and neglect [23]. A further

caveat includes the role of cultural and societal beliefs in determining the perceptions of what is considered child abuse and what it is not. Therefore, some of the risk factors identified may not be applicable in certain cultures and societies [9, 15].

2.2.5 Child Characteristics

Belsky and Vondra [25] indicate that child characteristics should be considered in conjunction with parental characteristics when examining parenting and the role it may play in child maltreatment [25]. The most solid child characteristic for child maltreatment victimization is the age of the child. Research has shown that children 4 years of age and younger are the most frequent victims of child abuse [9, 11], while the curve swings back up in adolescence [9]. NCANDS data for 2008 showed that children younger than 1 year accounted for 45% of fatalities, while children younger than 4 years accounted for nearly 80% of fatalities [11]. Younger children may be at greater risk for child abuse fatalities for many reasons, including their dependency and vulnerability [11]. Racial and ethnic information has been noted to increase the risk for child maltreatment; however, some studies indicate that when other variables, such as poverty, are controlled for, this correlation diminishes [10]. Others warn that reporting bias is the reason for correlation between race and child maltreatment [4]. Children born as the result of an unwanted pregnancy or children with particular needs, such as excessive crying or physical problems, have also been noted to be at increased risk for abuse [9].

2.2.6 Characteristics of the Parent or Caregiver

The 2008 child death data reported that child maltreatment deaths occurred at the hands of a parent either alone or with another person in 71% of the deaths, and the deaths from physical abuse occurred at the hands of the father or male caregiver, while the mother is responsible in the majority of deaths from neglect [11]. Studies from the 1960s and the 1980s showed that mothers were the perpetrators of abuse in almost half of maltreatment cases, but when an adult male was present in the home, the male was the perpetrator in two-third of the cases [4]. While the report indicates that there is no single profile of a perpetrator of child maltreatment, it does indicate that certain characteristics have been identified through research. These characteristics include that the perpetrator is a young adult in his or her 20s, with a low education level [4, 11], living at or below poverty level, depressed, may have difficulty with stressful situations, or may have experienced violence first-hand [11].

Other studies have centered on the mother and her interactions with the child. Mersky et al. [23] reported that maternal age at the time of child birth was the most reliable predictor of maltreatment [23]. Additional information has indicated that the mother's unwillingness or inability to bond with a newborn or nurture a child may show a potential for abuse [9, 14, 25]. Examining the work of Bowlby and later work by Answorth on attachment, Steele [14] notes that infants will, out of