

PREDICTING FACTORS OF ABUSIVE HEAD TRAUMA IN INFANTS WITHIN A CHILD
MALTREATMENT POPULATION

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ABSTRACT

PREDICTING FACTORS OF ABUSIVE HEAD TRAUMA IN INFANTS WITHIN A CHILD MALTREATMENT POPULATION

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Research into the predictors of child physical abuse has shown that caregivers that have perpetrated child physical abuse experience internalizing mental health concerns (stress, emotional distress, anxiety, and depression) more often than other caregivers. Domestic violence within the household is also related to caregivers who have perpetrated child physical abuse, as well as their own childhood abuse and neglect. Studies have also shown that younger caregivers are more likely than older caregivers to commit child physical abuse. With bountiful research on child physical abuse, there is very little on Shaken Baby Syndrome or Abusive Head Trauma (AHT). The current study examined the relationship between diagnosed mental illness of the caregiver, a presence of domestic violence, caregiver age, caregiver sex, marital status, number of children within the household and AHT, using the Fourth National Incidence Study of Child Abuse and Neglect (NIS-4) archival dataset on 12,694 abused or maltreated children collected by the Children's Bureau and the Office of Planning, Research and Evaluation in the Administration for Children and Families that took place in 2005 and 2006. This study found that caregivers aged 25 and younger are more likely to contribute to abusive head trauma than caregivers aged

26 and older and families with 2 or less children have a higher likelihood of abusive head trauma occurring within them than families with 3 or more children. There was no significance found in a relationship between abusive head trauma and mental illness within the caregiver, domestic violence within the household, marital status, or sex of the caregiver.

CHAPTER ONE: INTRODUCTION

In 2015, an estimated 4.1 million children were referred for child protective services in the United States, resulting in 18% or 738,000 of those children classified as victims of child abuse. (U.S. Department of Health & Human Services, Administration for Children and Families, Administration on Children, Youth and Families, Children's Bureau, 2017). Child abuse and neglect are thus an unfortunately common pattern in the interaction between many parents and their children (Timmer, Borrego, & Urquiza, 2002). More troubling still, negative health effects from abuse don't stop when the abuse stops; continuous medical difficulties, cognitive deficits, behavioral deficits, and socioemotional problems have all been documented in adult victims of childhood abuse (Barnett, Miller-Perrin, & Perrin, 1997). And while there is fortunately extensive research on child abuse risk factors, Shaken Baby Syndrome predictor research is almost nonexistent.

Shaken Baby Syndrome (SBS), also known as Abusive Head Trauma (AHT), is estimated to affect 1,000 to 3,000 babies each year in America (New York State, 2010). One-fourth of AHT victims die; of those who survive, eighty percent are left with permanent damage. AHT is a non-accidental form of trauma that afflicts children, usually under the age of four, and is caused by violent shaking (Kehbein, 2016). This type of child abuse is most commonly characterized by a triad: bleeding between the brain and its outermost covering (subdural hematoma); bleeding in the back wall of the eye (retinal hemorrhage); and, finally, abnormal brain function or structure (encephalopathy; (Christian & Block, 2009; Squier, 2008). Yet while there is substantial medical research concerning AHT and competing views of what should

constitute a diagnosis - there is little to no research on predictors of diagnosing AHT in medical cases.

The current study examined predictors of diagnosing AHT among infants who have been impacted by AHT and collected by the nation's child protective services and community professionals who recognized maltreatment. These predictors, based on child physical abuse risk factor studies, have largely been neglected in studies focused on AHT. This study specified predictors of AHT that were also variables in child physical abuse. The variables chosen for this study already have a relationship with child physical abuse and are being tested to try to identify them as predictors for AHT as well or note the differences.

CHAPTER TWO: LITERATURE REVIEW

Definitions

Child Abuse

The Federal Child Abuse Prevention and Treatment Act (CAPTA) (42 U.S.C.A § 51006g) defines child abuse 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...An act or failure to act which presents an imminent risk of serious harm.”* A “child” in this context is one younger than 18 years old and who is not an emancipated minor (Child Abuse Prevention and Treatment Act of 2010, p. 6). The Center for Disease Control and Prevention defines child abuse as *“words or overt actions that cause harm, potential harm, or threat of harm”* (Violence Prevention, 2016). Although harm might not be the intended outcome, these acts of commission are intentional and deliberate. Three types of this maltreatment include physical abuse, sexual abuse, and psychological abuse (Leeb, Paulozzi, Melanson, Simon, & Arias, 2008).

Shaken Baby Syndrome

Shaken Baby Syndrome (SBS) has had many different names over the years: “Whiplash Shaken Baby Syndrome,” “Shaken Impact Syndrome,” “Whiplash Shaken Infant Syndrome,” “Inflicted Childhood Neurotrauma,” “Non-Accidental Trauma,” and many others. The medical community has recognized it as “Abusive Head Trauma” (AHT). Legal literature, court decisions, and public media have followed suit, eliminating the term “Shaken Baby Syndrome” as it is understood to be an invalid medical diagnosis (Narang, 2011). Recently, the American Academy of Pediatrics (2009), Section on Child Abuse and Neglect, released a policy statement

recommending the use of “Abusive Head Trauma” as a more accurate and less mechanistically constricting term than “Shaken Baby Syndrome”.

Diagnosis. The diagnosis of AHT depends on the triad of subdural hemorrhage, retinal hemorrhage, and encephalopathy. Subdural hemorrhage is subdural bleeding originating within deep layers of the dura and possible sources of this are bridging veins, small vessels in the dura, granulating hemorrhagic membrane, and ruptured intracranial aneurysm. Retinal hemorrhage is bleeding within the dural and subarachnoid optic nerve sheath. Encephalopathy is used generally to describe AHT. This can be specified as multiple symptoms: irritability, vomiting, feeding difficulties or floppiness to seizures, apnea, and fulminant brain swelling (Squier, 2011).

Although, this triad of symptoms usually result from shaking, blunt impact, or a combination of shaking and blunt impact causes injuries as well (Christian & Block, 2009). Duhaime et al.

(1987) concluded that blunt impact was needed to cause the intracranial injuries in AHT.

Alexander, Sato, Smith, and Bennett (1990), however, found intracranial injuries seen in patients without evidence of external trauma had equal severity compared to patients with direct head trauma. This resulted in the finding that shaking alone can cause these injuries observed in AHT.

Theories

Child Abuse

The Social-Information Processing Theory shown in Figure 1 (Azar, Reitz, & Goslin, 2008) focuses on cognitive processes of maladaptive parenting. This theory postulates three primary elements of cognition: schema, executive functioning, and their products - appraisals and attributions. This theory also considers the influence of culture, social support, neighborhood, and child and partner characteristics interacting with cognitive processes to yield parenting responses.

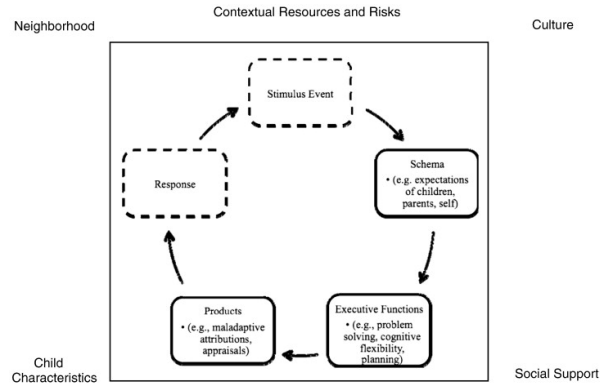


Fig. 1 The Social Information Processing Theory

Each element within this theory may generate emotion, stimulating new networks of knowledge structures (e.g., child schema, parenting schema), influencing which executive functioning factors are triggered and which appraisals are made (Azar, Reitz, & Goslin, 2008).

The attachment theory (Crittenden & Ainsworth, 1989) suggests that individuals who have a history of insecure attachment as children are at a higher risk for modeling insecure attachment patterns in adulthood. From the attachment-related dynamics, parents who were maltreated as children would be less likely to show sensitivity in interactions with their own children. These theories suggest maltreated parents will have different behaviors than non-maltreating parents, however, observational studies can only offer limited support (Crittenden & Ainsworth, 1989).

Child Physical Abuse

Theories of child physical abuse are numerous in comparison to its subcategory, AHT. Because of this, no reputable AHT theory availability, and the similarity between the two types of abuse, Berkout and Kolko's (2016) model of dysfunction will be the overarching theory used for AHT. Berkout and Kolko examined a sample of 195 caregivers seeking services due to experiencing significant familial aggression and conflict. Data collected from this sample led Berkout and Kolko to the conclusion that positive parenting and negative affect help explain the

impact of parenting distress on child-directed aggression (2016). This model also explains that caregivers experiencing more parenting stress and more internalizing symptoms may be more likely to express child-directed aggression. Also, parents who experience higher rates of stress tend to experience less positive parenting interactions, which can contribute to child-directed aggression (Berkout & Kolko, 2016).

Although not currently being utilized in this study, other models propose that emotion regulation is composed of selection/avoidance of situations, control of attention, cognitive reappraisal, and modulation of physiological, emotional, and behavioral response. Caregivers may feel more parenting stress due to failure to adapt to and modify situations leading to greater negative emotion. Caregivers may then fail to control their behavioral responding from limited positive parenting, resulting in child-directed aggression (Gross & Thompson, 2007).

A final theory that is supplemental in understanding child physical abuse - though not being used to help explain AHT - is Wolfe's transitional model of abuse (1987). Wolfe holds that parents go through three stages culminating into abusive parenting. There are a variety of destabilizing and compensatory factors in each stage. The first stage involves generally reducing tolerance for stress and disinhibition of aggression. The second stage is characterized by poor management of acute crises and provocation. The last stage is habitual patterns of arousal and aggression with family members. The characteristics of the parent-child relationship, parent(s), family, and larger social context are there to destabilize or compensate, moving the parent within the continuum. This, in turn, is either toward or away from abusive behavior (Wolfe, 1987).

Abusive Head Trauma

Stephens, Kaltner, Larkins, Franklin, Taey, Stewart, and Stewart (2012) provide a theory to explain AHT by proposing a three-part model explaining the etiology. Within the model,

factors related to the baby, situational factors, and factors related to caregiver interact leading to AHT. Factors related to the baby are focused on child development characteristics (i.e., crying pattern and separation anxiety). Situational factors include stressful situations (i.e., natural disasters, social status, difficulties during pregnancy, and family isolation). Factors related to the caregiver involve lack of knowledge about normal patterns of crying, risks of shaking, frustration tolerance, lack of experience, psychopathological factors, and envy of the relationship between the baby and other caregivers (Stephens, Kaltner, Larkins, Franklin, Taey, Stewart, & Stewart, 2012).

This study is delving into the differences and similarities of abusive head trauma and child physical abuse. While abusive head trauma is a subcategory of child physical abuse, there is little research on the specific predictors of abusive head trauma. Abusive head trauma tends to occur while the victim is an infant while child physical abuse most often occurs at ages 4-7 or 12-15 (U.S. Department of Health & Human Services, Administration on Children, Youth and Families, 2007). These ages and symptoms of irritability, vomiting, feeding difficulties or floppiness to seizures, apnea, and fulminant brain swelling differentiate abusive head trauma from child physical abuse (Squier, 2011). With such little research on predictors of abusive head trauma, more differences are unknown and require a deeper look into abusive head trauma predictive characteristics.

Barr (2012) explained that increased crying in an otherwise normal infant is a trigger for AHT. This is clarified by the notion that unsoothable crying in an infant means something is wrong with the interaction between the caregiver and infant. Barr reported that incessant crying in the earlier than normal months of an infant's life in combination with a failure of normal

caregiver-infant interaction is the conceptual core for provided prevention efforts of AHT (Barr, 2012).

Risk Factors

Child physical abuse

Perpetrator risk factors.

Perpetrator's age. A study by Wolfner and Gelles (1993) based on the results from the Second National Family Violence Survey (NFVS) found that younger, compared to older caregivers reported more minor, not severe, child physical abuse. Using data from a 1995 National Survey of Child Maltreatment and Parenting (NSCMP), Straus, Hamby, Finkelhor, Moore, and Runyan (1998) also found younger parents were moderately more likely to commit minor child physical abuse. This study also found a parent's age was only slightly related to severe child physical abuse. Using a sample of 7,103 parents from the Epidemiological Catchment Area (ECA), Chaffin, Kelleher, and Hollenberg (1996) found no significant association between parents' age and severe child physical abuse. According to a study of 195 caregivers seeking services due to experience of family aggression or conflict, Berkout and Kolko (2016) found that younger caregivers generally reported more child-directed aggression, drug and alcohol use, worse parenting, and an increased risk of offending. Finally, in a sample of 1,997 mothers, Connelly and Straus (1992) found a weak association of the younger a woman was when she gave birth, the more likely she was to commit severe child physical abuse. Examining the medical records of 120 children from a hospital in Mexico City, Mexico, Díaz-Olavarrieta, García-Piña, Loredó-Abdala, Paz, Garcia, and Schilman (2011) found that the children with AHT were more likely to have mothers aged 17-19. These findings are inconsistent with each other.

Parent sex. Three studies analyzed data from the 1985 NFVS finding conflicting results (Straus, 1994; Wauchope & Straus, 1990; Wolfner & Gelles, 1993). The studies conducted by Chaffin et al. (1996) and Straus et al. (1998) did not find significance in the relationship between parent gender and likelihood of committing minor or severe child physical abuse.

Marital status. Both Connelly and Straus (1992) and Chaffin et al. (1996) found no significant relationship between committing severe child physical abuse and marital status.

Number of children. Using the 1985 NFVS sample, studies found that as the number of children in a family increase, the risk for minor and severe child physical abuse increases (Connelly & Straus, 1992; Straus, 1994; Wolfner & Gelles, 1993). However, using the ECA sample, another study did not find a significant relationship between the likelihood of severe child physical abuse and the number of children (Chaffin et al, 1996).

Personal history variables. Considering the personal history of perpetrators of child physical abuse. Whipple and Webster-Stratton (1991) compared mothers who committed child physical abuse with mothers who had not, on a childhood social support measured with only one item. When describing their childhoods, mothers who had committed abuse had a smaller likelihood of feeling supported by their own mothers than mothers who had not committed child physical abuse. Looking at childhood punishment experiences by the perpetrator, three studies using the 1985 NFVS samples found that parents previously physically punished as children had a great risk of perpetrating child physical abuse (Ross, 1996; Straus, 1994, p. 230; Straus & Smith, 1990). Ross (1996) also found experiencing corporal punishment as a teen was high risk factor of perpetrating severe child physical abuse after controlling for child age, socioeconomic status, race, parent age, child gender, wife-to-husband aggression, and husband-to-wife aggression. Straus and Smith (1990) found that this increased risk was there whether teens were

hit by mothers or fathers. Straus (1994) found parents who were hit as teens are at higher risk for using minor child physical abuse. Comparing mothers who commit child physical abuse and mothers who do not, Coohy and Braun (1997) found the mothers who commit child physical abuse were more likely to indicate that they had been physically victimized by their parents. Whipple and Webster-Stratton (1991) found that mothers who were currently residing in households where child physical abuse was reported, had a higher likelihood of perceiving themselves being abused by their own mothers as children than other mothers, but did not differ on severity of maternal or paternal discipline.

One distinct category of perpetrators included those who witnessed parental aggression as children. Using the 1985 NFVS sample, one study found parents who perpetrated severe child physical abuse, compared to parents who did not, had a higher likelihood to have witnessed violence between their own parents (Straus, 1994). Straus and Smith (1990) found that parents who had witnessed their mothers hit their fathers committed higher rates of severe child physical abuse than parents who did not witness such abuse, with mixed results for witnessing father-to-mother aggression. They also found that women who witnessed father-to-mother aggression were more likely to use severe child physical abuse than other women. There was no differentiation between mothers who commit child physical abuse and mothers who do not when looking at parental substance abuse during their childhood (Starr, 1982). Finally, others who have committed child physical abuse compared to other mothers had a higher number of unplanned conceptions, including those while using and not using birth control (Zuravin, 1987).

Stress. Three studies (Conger, Burgess, & Barrett, 1979; Rosenberg & Reppucci, 1983; Coohy & Braun, 1997) found that parents who have committed child physical abuse, compared to other parents, reported more stressful life changes. Gaines et al. (1978) found no differences.

By analyzing a modified Social Readjustment Rating Scale item-by-item, Starr (1982) found that mothers who have committed child physical abuse, compared to other mothers, had a higher likelihood of reporting experiences, such as, a recent stressful death, economic problems in the past month, and childbearing problems in the last month. Using the Life Events Inventory (LES, Cochrane & Robertson, 1973), Pianta et al. (1989) found that mothers who have committed child physical abuse scored higher than other mothers on a similar measure, which measured the number of negative life changes over the year. Whipple and Webster-Stratton (1991) also found that mothers who have committed child physical abuse, compared to other mothers, scored higher on the LES (for total life change and negative life change), but fathers from these two groups did not differentiate. Mothers who have committed child physical abuse also scored higher on their perception of daily stress (Williamson, Borduin, & Howe, 1991). However, Gaines et al. (1978) used the Family Life Form D, an inventory of 32 negative life incidents typically experienced by low income housing families and did not find differences between mothers who have committed child physical abuse and other mothers. Chan (1994) and Mash, Johnson, and Kovitz (1983) both found that mothers who have committed child physical abuse, compared to other mothers, report more parenting stress. Berkout and Kolko (2016) found parenting stress predicted higher negative affect, which was related to increased child-directed aggression. Although parenting stress did not have a direct association with child-directed aggression, it was associated with less positive parenting, which is predictive of increased child-directed aggression.

Emotional distress. Using the Child Abuse Potential Inventory, Milner and Robertson (1990) and then Caliso and Milner (1992) found the mothers who have committed child physical abuse, compared to other mothers, reported higher rates of general distress. The women also

reported higher rates of emotional distress on the Cornell Medical Index compared to low socioeconomic status and middle socioeconomic status other mothers (Cornell Medical College, 1949). Also, Conger et al. (1979) found that out of 40 participants, parents who have committed child physical abuse reported more emotional distress on the Cornell Medical Index.

Anxiety. Using the State-Trait Anxiety Inventory (Spielberger, Gorsuch, & Lushene, 1970), comparing parents who have committed child physical abuse and other parents, Lahey, Conger, Atkenson, and Treiber (1984) found that mother who have committed child physical abuse report more trait anxiety than low to medium socioeconomic status other mothers. Interestingly, Whipple and Webster (1991) found that parents who have committed child physical abuse, compared to other parents, report higher state anxiety but did not contrast on trait anxiety. In a prospective longitudinal study, Pianta and colleagues (1989) found that mothers who have committed child physical abuse, compared to other mothers, reported higher anxiety on the Institute for Personality and Ability Testing Anxiety Scale (Cattell, 1967) on the 48-month assessment.

Depression. Chaffin et al. (1996) used the ECA sample and found that parents who have committed severe child physical abuse, compared to other parents, were more often diagnosed with Major Depressive Disorder. Using the 1985 NFVS sample, Straus (1994) found the parents who have committed child physical abuse, compared to other parents, reported more depressive symptoms. Three more studies found the mothers who have committed child physical abuse, compared to other mothers, reported more depressive symptoms, suggesting depression as a risk factor for child physical abuse (Lahey et al. 1984; Pianta et al., 1989; Whipple & Webster-Stratton, 1991).

Victim risk factors.

Child age. Four studies were found regarding the victim's age: two studies using the 1985 NFVS sample (Connelly & Straus, 1992; Wolfner & Gelles, 1993), one using the NSCMP data (Straus et al., 1998), and the last one using the NIS-2 (Sedlak, 1997). Using the 1985 NFVS sample, Wolfner and Gelles (1993) found the association between child age and both minor and severe child physical abuse was curvilinear, peaking at children age 3 through 12. Connelly and Straus (1992) used a multivariate analysis on the 1985 NFVS sample, finding child age was not a significant predictor of severe child physical abuse. Straus et al. (1998) produced similar results with the NSCMP data: the child's age was moderately related to minor, but not severe child physical abuse. Sedlak (1997) found that the association between the child's age and child physical abuse depended on family structure and race. The greater risk fell with older children when both parents were present or if their ethnic background was Hispanic or African American.

Family risk factors.

Family stress. Williamson and colleagues (1991) found that physically abused adolescents, compared to other adolescents, had a higher likelihood of coming from families experiencing high degrees of family stress.

Partner verbal aggression. Using the 1985 NFVS sample, Straus and Smith (1990) found that parents with higher levels of partner-to-partner aggression – in either direction - were more likely to commit severe child physical abuse.

Partner physical aggression. Ross (1996) found that any husband-to-wife physical aggression was a significant predictor of his severe child physical abuse, while any wife-to-husband aggression was a significant predictor of her severe child physical abuse. Straus (1994) noted that any aggression between parents was related to committing minor child physical abuse. Coohy and Braun (1997) found similar results using a clinical comparison design: mothers who

have perpetrated child physical abuse, compared to other mothers, were more likely to have experienced husband-to-wife aggression from their current partner and ex-partner. According to Margolin, Gordis, Medina, and Oliver (2003) co-occurrence percentages for husband-to-wife aggression and child abuse potential range from six percent to fourteen percent.

Mother-father interactions. Silber et al. (1993) observed that both parents from child physical abuse families, compared to other families, were more critical toward each other. For positive behavior, Silber et al. (1993) found that fathers who have perpetrated child physical abuse, compared to other fathers, displayed agreement with their wives less. Mothers, meanwhile, did not differ on the amount of sharing, guiding interaction, and agreement.

Abusive Head Trauma

Perpetrator risk factors.

Perpetrator's age. Hennes, Kini, and Palusci (2001) found that mothers younger than 18 increase the probability of AHT within the household.

Perpetrator gender. Using 151 medical cases of infants who suffered AHT, Starling, Holden, and Jenny (1995) found that males outnumbered females 2.2:1 in perpetrating AHT. In a study of 5,195 infants, of those were diagnosed with AHT, males were the documented as the perpetrator in 67.4% of the cases compared to females (Nuno, Pelissier, Varshneya, Adamo, & Drazin, 2015). However, using 627 cases in a retrospective study of infants, Guenther, Powers, Srivastava, and Bonkowsky (2010) found that male gender was not significantly different comparing those with and without AHT. A retrospective chart review of 34 AHT cases from 1998 to 2008 found that fifty percent of the children with AHT were injured by women (Esernio-Jenssen, Tai, & Kodsi, 2011).

Marital Status. Hennes, Kini, and Palusci (2001) found that single-parent families increase the probability of AHT within the household.

Victim Risk Factors.

Child Age. Mori, Kitazawa, Higuchi, Nakamura, and Murata (2013) reviewed 37 AHT cases and found that male infants had a higher likelihood of receiving AHT than female infants. In a retrospective epidemiological study of 37 AHT cases, Tursz and Cook (2014) also found that male victims of AHT were more common than female victims.

Model and Hypotheses

The present study examined potential predictors of the diagnosis of AHT. This study is needed given the lack of research conducted on the risk factors specifically for AHT. Consequently, there is no research on the mental health, family dynamic, and personal history of the caregivers perpetrating AHT. This is troubling given (1) the sheer volume of reported AHT in America, (2) the lack of knowledge regarding predictors of AHT in the medical literature, and (3) the fact that the mental health of a significant number of child physical abuse perpetrators may contribute to the incidences of AHT. The age of the caregivers were also examined as a predictor of the diagnosis of AHT. Berkout and Kolko's (2016) model of dysfunction were used in creation of the following hypotheses in understanding the predictors further.

This study tested three hypotheses:

1. Mental health disorders within the caregivers are predictive to the diagnosis of abusive head trauma.
2. A history and current domestic violence within the household will predict a higher likelihood of abusive head trauma diagnosis.
3. Younger parent age will predict a higher likelihood of abusive head trauma diagnosis.

The present study also examined predictors with less conclusive findings within the existing research. Due to mixed results among experiments, parent gender, marital status, and number of children were examined as possible predictors of the diagnosis of AHT.

This study will ask three research questions:

1. Is caregiver gender a predictor of diagnosing abusive head trauma?
2. Is marital status of the caregiver a predictor of diagnosing abusive head trauma?
3. Is the number of children within the household a predictor of diagnosing abusive head trauma?

CHAPTER THREE: METHODS

Participants

Participants for the current study consist of 12,694 abused or maltreated children via the Fourth National Incidence Study of Child Abuse and Neglect (NIS-4) archival dataset collected by the Children's Bureau and the Office of Planning, Research and Evaluation in the Administration for Children and Families. These children range in age from less than one month to 17, with 1689 missing ages or no birth date available. Within this dataset, there are 6,046 male victims, 6217 female victims, and 431 missing or uncertain sex of the maltreated children.

Within these 12,694 cases, there are 31 archival cases of infants who have been affected by abusive head trauma. The AHT afflicted children ages range from less than one month old to two-years-old and include 22 females and 8 males, with one child's sex unknown. This dataset is the most recent of a four-part dataset.

Procedure

Retrospective data were collected between 2005 and 2006 via the Fourth National Incidence Study of Child Abuse and Neglect (NIS-4) archival dataset of 12,694 abused or maltreated children collected by the Children's Bureau and the Office of Planning, Research and Evaluation in the Administration for Children and Families. The National Incidence Studies are conducted once every ten years, starting in 1974, in response to requirements of the Child Abuse Prevention and Treatment Act. The NIS-4 used a national sample of 122 counties, and surveyed children that were reported to child protective services and that were suspected to be abused or maltreated and any children that were reported to the child protective and resulted no findings of abuse. This was collected by 126 children protective services agencies and 11,321 sentinels

(trained professionals from law enforcement agencies, health services, schools and day care centers, and housing/shelters). Eligible sentinels from these agencies included officers, head nurses, counselors, and public housing social workers.

The NIS-4 used three primary data collection instruments: the CPS Maltreatment data form, the CPS Summary data form, and the Sentinel data form. CPS agencies used the CPS Maltreatment data form to provide details of the children and maltreatment events for a sample of cases reported to the agency during the study reference period that they accepted for investigation. The CPS Summary data form was used to collect demographic information on the remaining, unsampled cases, for use in unduplication. The Sentinel data form was used for all children they suspected were maltreated during the reference period. For training, sentinels and CPS agency staff were given books with general instructions, definitions, and item-by-item specifications for completing their data forms. Local coordinators met with the sentinels between every two to four weeks.

The 31 AHT cases will be analyzed against the other 12,663 cases using SPSS software.

Analyses

Chi Square Tests of Independence was used to determine if each hypothesis and question resulted in a significant association (Pearson, 1900). After ascertaining if each hypothesis and question was supported or answered, a hierarchical linear regression was performed to ascertain if predictors and sex of caregiver, marital status within the household, and number of children in the household predicted on the likelihood of shaken baby syndrome above and beyond parental mental illness and age. To analyze the dataset using a hierarchical linear regression and tests of independence, all the variables were transformed into dichotomous data if it was not otherwise.

The variable needed for hypothesis 1 and 2, and research question 1 was already dichotomized so no changes were made. For hypothesis 3, the caregiver age variable was dichotomized into caregivers 25 years and younger being defined as the “Young caregivers” and 26 years and older as “Older caregivers”. Mean imputation was used on any data that was missing in the age variable, using the average score of other individuals in the sample as the missing variable code (Gelman & Hill, 2006). For research question 2, the marital status variable was dichotomized from their original codes of “Married parents, both biological” and “Married parents, other legal arrangements” into married as “1” and “Unmarried parents” and “Single parent, with partner” to nonmarried as “0”. For research question 3, the number of children dichotomized into households of 2 or less children as “Fewer children” and households of 3 or more children as “More children”. Only the reported instances of abusive head trauma were coded as “1” so anything missing or not reported was coded as “0”.

CHAPTER FOUR: RESULTS

To test hypothesis 1, a chi-square test of independence was conducted to determine if there is a relationship between shaken baby syndrome from physical abuse and mental illness in the caregiver being a suspected factor in physical abuse. All expected cell frequencies were greater than five, except one cell with the minimum expected count 0.61. There was not a statistically significant association between shaken baby syndrome from physical abuse and mental illness in the caregiver being a suspected factor in physical abuse, $\chi^2(1) = 2.326, p = .127$. The association was small (Cohen, 1988), Cramer's $V = .014$. This hypothesis was not supported.

Table 1

Crosstabulation of Shaken Baby Syndrome and Mental Illness in the Caregiver

Shaken Baby Syndrome	Mental Illness in the Caregiver	
	Yes	No
Yes	0	31
No	884	11779

Note. Numbers represent observed frequencies

Hypothesis 2 was analyzed using a chi-square test of independence to determine if there is a relationship between shaken baby syndrome from physical abuse and domestic violence within the home. There was no variability in the domestic violence variable; therefore, a test for associations and differences could not be made. The absent variability was due to every case

denying or missing the data point of domestic violence within the household when shaken baby syndrome was reported as an occurrence. This hypothesis was not supported.

To test hypothesis 3, a chi-square test of independence was conducted to determine if there is a relationship between shaken baby syndrome from physical abuse and age of the caregiver. All expected cell frequencies were greater than five. There was a statistically significant association shaken baby syndrome from physical abuse and age of the caregiver, $\chi^2(1) = 344.219, p < .0005$. The association was small (Cohen, 1988), Cramer's $V = .165$. Caregivers aged 25 and younger are more likely to contribute to abusive head trauma than caregivers aged 26 and older.

Table 2

Crosstabulation of Shaken Baby Syndrome and Age of Caregiver

Shaken Baby Syndrome	Age of Caregiver	
	25 and Younger	26 and Older
Yes	20	7
No	2200	8961

Note. Numbers represent observed frequencies

To test question 1, a chi-square test of independence was conducted to determine if there is a relationship between shaken baby syndrome from physical abuse and sex of the caregiver. All expected cell frequencies were greater than five. There was not a statistically significant association between shaken baby syndrome from physical abuse and sex of the caregiver, $\chi^2(1) = 3.206, p = .073$. The association was small (Cohen, 1988), Cramer's $V = .016$. This data did not result in an answer for the first question.

Table 3

Crosstabulation of Shaken Baby Syndrome and Sex of Caregiver

Shaken Baby Syndrome	Sex of Caregiver	
	Male	Female
Yes	1	29
No	1886	10673

Note. Numbers represent observed frequencies

Question 2 was analyzed using a chi-square test of independence to determine if there is a relationship between shaken baby syndrome from physical abuse and married caregivers versus nonmarried caregivers. All expected cell frequencies were greater than five, except one cell with the minimum expected count 2.03. There was not a statistically significant association between shaken baby syndrome from physical abuse married caregivers versus nonmarried caregivers, $\chi^2(1) = .834, p = .361$. The association was small (Cohen, 1988), Cramer's $V = .008$. This data did not result in an answer for the second question.

Table 4

Crosstabulation of Shaken Baby Syndrome and Marital Status Within the Home

Shaken Baby Syndrome	Marital Status	
	Married	Nonmarried
Yes	7	21
No	3958	7989

Note. Numbers represent observed frequencies

To test question 3, a chi-square test of independence was conducted to determine if there is a relationship between shaken baby syndrome from physical abuse and number of children in the household. All expected cell frequencies were greater than five, except one cell with the

minimum expected count 1.81. There was a statistically significant association between shaken baby syndrome from physical abuse and number of children in the household, $\chi^2(1) = 4.786, p = .029$. The association was small (Cohen, 1988), Cramer's $V = .020$. Families with 2 or less children have a higher likelihood of abusive head trauma occurring within them than families with 3 or more children.

Table 5
Crosstabulation of Shaken Baby Syndrome and Number of Children Within the Home

Shaken Baby Syndrome	Number of Children	
	2 or Less	3 or More
Yes	20	8
No	6180	6001

Note. Numbers represent observed frequencies

To analyze the two hypotheses together, a binomial logistic regression was performed to ascertain the effects of mental illness in the caregiver being a suspected factor in physical abuse and age of the caregiver on the likelihood of shaken baby syndrome (Step 1). The logistic regression model was statistically significant, $\chi^2(2) = 38.941, p < .005$. The model explained 9.1% (Nagelkerke R^2) of the variance in shaken baby syndrome and correctly classified 99.8% of cases. Of the two predictor variables only one was statistically significant: caregiver age. Caregivers 25-years-old and younger are 8.8 times more likely to be associated with abusive head trauma than caregivers 26-years old and older.

A hierarchical linear regression was performed to ascertain if predictors and sex of caregiver, marital status within the household, and number of children in the household (Step 2) predicted on the likelihood of shaken baby syndrome above and beyond parental mental illness and age (Step 1). The addition of the three new predictors in Step 2 accounted for 2% more

variance in shaken baby syndrome, which was significant $\Delta \chi^2(1, N = 31) = 7.797, p = .005$. The overall logistic regression model was in Step 2 statistically significant, $\chi^2(5) = 46.738, p < .005$. The model explained 12.1% (Nagelkerke R2) of the variance in shaken baby syndrome and correctly classified 99.8% of cases. Of the two models and five predictor variables only one was statistically significant: caregiver age (as shown in Table 6). Caregivers 25-years-old and younger are 10 times more likely to be associated with abusive head trauma.

Table 6
Logistic Regression Predicting Likelihood of Abusive Head Trauma based on Mental Illness in the Caregiver, Caregiver Age, Sex of Caregiver, Marital Status within the Household, and Number of Children in the Household

	<i>B</i>	SE	Wald	<i>df</i>	<i>P</i>	Odds Ratio
Mental Illness	-15.285	1280.793	.000	1	.990	.00
Caregiver Age	-2.307	.430	28.787	1	.000	.100
Caregiver Sex	-1.079	1.030	1.097	1	.295	.340
Marital Status	-.071	.444	.026	1	.873	.931
# of Children	-.568	.424	1.795	1	.180	.567

CHAPTER FIVE: DISCUSSION

The current study examines predictors of AHT diagnosis among infants who have been impacted by abusive head trauma. These predictors, based on child physical abuse risk factor studies, have largely been neglected in studies focused on AHT. Overall, findings indicated that individually caregiver age and the number of children within the household are associated with abusive head trauma of infants inside the home. Caregivers aged 25 and younger are more likely to contribute to abusive head trauma than caregivers aged 26 and older. Families with 2 or less children have a higher likelihood of abusive head trauma occurring within them than families with 3 or more children. Although the number of children within the household impacted infants' likelihood of receiving abusive head trauma, when analyzed with other possible predictors this association becomes not significant. Interestingly, this finding was completely inconsistent with previous studies, where they found that as the number of children in a family increase, the risk for minor and severe child physical abuse increases (Connelly & Straus, 1992; Straus, 1994; Wolfner & Gelles, 1993). This may be due to other children within the household taking on the caregiver role when the original caregiver is unable to perform (i.e., exhaustion), reducing the time an infant is in the original caregiver's care. The association of abusive head trauma and caregiver age remains significant when analyzed with other possible predictors of abusive head trauma. Caregivers 25-years-old and younger have 13.6 percent higher odds to be associated with abusive head trauma. This is consistent with the findings of previous studies, which noted that younger caregivers reported more child physical abuse (Berkout & Kolko; Connelly & Straus, 1992; Díaz-Olavarrieta, García-Piña, Loredó-Abdala, Paz, García, & Schilmann, 2011; Straus, Hamby, Finkelhor, Moore, & Runyan, 1998; Wolfner & Gelles, 1993).

This may also be a factor in the significance found of number of children within the household. With more children in the house, the parents are usually older and more capable of handling children, while younger parents yield less children, resulting in higher frustrations and a higher likelihood of AHT. There was no significance found in a relationship between abusive head trauma and mental illness within the caregiver. There was no relationship found between abusive head trauma and domestic violence in household. There was also no significance found between abusive head trauma and marital status of the caregiver or sex of the caregiver.

This study found younger caregiver age as a predictor of abusive head trauma in infants. This has added to previous literature with similar findings. While it has not found associations between abusive head trauma and other variables like previous studies of child physical abuse, it has created an awareness for younger parents and caregivers. Younger parent age tends to mean less children, which was also associated with higher rates of abusive head trauma. Overall, the inexperience of being a new parent and stressors that younger parents experience may have increased this significance of being a predictor for abusive head trauma in infants.

Limitations

The findings of this study should be viewed within the context of its limitations. This dataset was collected by NIS-4, which may have inconsistent definitions of abusive head trauma or shaken baby syndrome. Additionally, the educational and training background of the data collectors were not noted. Therefore, it is possible that the data collectors were not adequately trained to assess child physical abuse. This data set is potentially outdated, and that additional data collection should be conducted to maintain the consistency and relevance of these findings.

Another limitation specific to the mental illness variable that was used in this study, is simply that there was only the suspected factor of mental illness. Within the domestic violence

variable that was used in this study, there was no variability that could even create an association with abusive head trauma.

According to Austin and Steyerberg (2015), the necessary power required to analyze a dataset using a regression requires that for every variable tested against the dependent variable, there must be 10 subjects. This rule may have affected the results of the hierarchical linear regression as there were 31 subjects with AHT and 5 variables were being tested. This is 2 variables over the recommended limit.

Future Research

Future studies may collect data from medical sites that check for abusive head trauma by suggestion from child protective or emergency services. This may make it possible for more contemporary and in-depth data collection. Future studies may also ask participants about their experience with abusive head trauma, and whether or not domestic violence occurred previously to the abusive head trauma as in such studies. (Coohey & Braun, 1997; Margolin, Gordis, Medina, & Oliver, 2003; Ross, 1996; Straus, 1994). If possible, a more thorough diagnostic assessment of the specific symptoms of potential mental illnesses, rather than just a suspected factor of mental illness, would help combat the risk of inaccurate diagnoses. The use of longitudinal data would allow for more robust conclusions, such as analyzing changes in the previous three datasets in this collection by the Children's Bureau, the Office of Planning, Research and Evaluation in the Administration for Children and Families in 1980, 1987, and 1996.

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