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Nature and Nurture: How they play a role in Serial Killers and their Victims (1970-1999)

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Senior Honors Project

**Submitted in partial fulfillment of the graduation requirements
of the Westover Honors College**

Westover Honors College

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Abstract

Investigating the relationship between a serial killer's nature (their biological makeup) and nurture (their learned behavior) is important due to the fact that any trauma they experienced as a child makes them more likely to offend as an adult. This study investigated how nature (e.g., biological brain damage and the MAOA gene) and nurture (e.g., their physical upbringing) affected serial killers, specifically the number of their victims, during the 'serial killer era' (1970 to 1999). All serial killers meeting our criteria were studied to determine to what extent they were abused as a child, the number of victims they had, and the number of head injuries they had. Previous studies provided additional context to the potential roles of brain damage and variants of the MAOA gene in serial killings. Data was quantified and subjected to statistical analyses (i.e., t-test, univariate analysis, and multivariate analysis) to determine if there was any correlation between childhood abuse, brain damage, and the number of the serial killer's victims. Because brain scans and MAOA gene sequencing are only available for select serial killers, this data was qualitatively described. This study provides greater awareness to the effects of childhood abuse, traumatic brain injuries, and genetics in producing serial killers, which could ultimately lead to potential interventions in childhood that prevent serial killers from making the conscious decision to hurt others as adults.

Statement of the Problem

It was 17th April 1977. A young couple, Valentina Suriani and Alexander Esau, was sitting, talking to each other in a parked car just a block away from her house. They thought it was just like any other day... until it was not. A seemingly normal man walked up to them as they were kissing and, without cause, shot both of them two times with a .44-caliber revolver and ended up killing them (one died at the scene and the other at the hospital (Davila & Liff, 1977)). The killer left a note at the scene for police announcing who he was, what he had done, and what he would continue to do: "Come and get me. Son of Sam" (Fowler et al., n.d.). This note, along with the revolver that was used as the murder weapon, connected Valentina and Alexander's attack to seven other attacks spanning from 29 July 1976 to 31 July 1977 (Fowler et al., n.d.). They were the victims of the sixth attack in a series of eight by The Son of Sam.

The killer known as The Son of Sam was identified as David Berkowitz, a 'casualty' of childhood abuse and head injury. He was arraigned for five murders and six attempted murders in August 1977. Eventually, he plead guilty to committing six of the eight shootings and was sentenced to serve 365 years in prison. This sentencing made Berkowitz a prime example of the damage that was being done in the United States during the serial killer era of the late twentieth century.

After hearing this example, it is interesting to examine the *before* of this killer and others 'like him' and compare it to the *after* that we know about currently. Maybe some factors can relate the past to the present and increase our understanding of it all. The factors to be looked at in this study are childhood abuse, brain damage as head injuries, and genetics in terms of MAOA.

Child Abuse

Julius B. Richmond, the U.S. Surgeon General from 1977 to 1981, described violence as “a public health crisis of the highest priority” (Listenbee et al., 2012, p. 3). Robert L. Listenbee, Jr., the Chief of the Juvenile Unit of the Defender Association of Philadelphia, stated that: “the exposure of [2 out of 3] children to violence is a uniquely traumatic experience that has the potential to profoundly derail the child’s security, health, happiness, and ability to grow and learn — with effects lasting well into adulthood” (Listenbee et al., 2012, p. 3). In other words, those exposed to violence as children (e.g., childhood trauma, crime, abuse, psychological trauma) appear to be more likely to commit criminal acts as an adult which may even include serial killings (Marono et al., 2020; Mitchell & Aamodt, 2005).

Data shows that there are between twenty and fifty serial killers (Čirjak, 2021) and thousands of victims in the United States during any given century (Aamodt, 2016). However, serial killers are more prevalent during some time periods. A top example of this would be the mid- to late-twentieth century. Of the total 2604 identified serial killers and 7843 victims during the entire twentieth century, 2292 (88%) killers and 6449 (82%) victims came from this period which would later be known as the ‘serial killer era’ (Vronsky, 2021). The number of victims here in this era, however, is not proportionate to those that are actually affected by these types of killers. This number includes the victims that are known to be connected to the killers. It does not include those whose lives were drastically and dramatically changed forever because they knew the individual who was killed by a serial killer (Douglas & Olshaker, 1998). These *unknown victims*, on average, account for five lives forever changed for every one victim added to a serial killer’s victim tally total (Krull, 2022).

Brain Damage

Acquired and traumatic brain damage is a “major unresolved public health problem” (Kraus et al., 1984, para. 2) that can cause an extreme extent of damage leading to both mental and physical issues (Krause et al., 1984; Ronca et al., 2016). The most notable and dangerous being neurological sequelae, a condition that results from a collection of complications involving an individual’s central nervous system. It can lead to “cognitive, sensory, or motor deficits that may also manifest as emotional instability and seizures in the most severe cases” (Ronca et al., 2016, para. 1). Although this condition is not seen often, it still shows the drastic impact that head injuries can have. After all, these types of injuries increase the risk of brain damage and acting differently after the fact. It is mostly the same for an adult as it is a child. The main difference is that those that suffer this as a child have their brains, or one of the lobes (frontal, temporal, parietal, occipital) within it, permanently altered for the rest of their lives before their brains have even finished developing. This leads to the damage having a bigger impact on their future self as their personality/decision making/emotions, short-term memory/speech, spatial awareness/touch/pain, and vision respectively might affect their actions (JHM, 2021).

Those that sustain brain damage have some level of continuing hardship after the initial injury (Kraus et al., 1984). In general, an individual’s recovery depends on the length of time between when their injury occurred and the present. Approximately 7% of individuals, however, suffer a worse fate (Krause et al., 1984; Ronca et al., 2016). A study conducted between 1987 and 1991 found that the mean incidence rate for a traumatic brain injury [TBI] in children was 12 out of 100,000 and permanent functional impairment was seen in 6 out of 100,000 (Emanuelson & Wendt, 2008). In other words, for every two children that suffer a TBI, one will have a permanent impairment. This means that, of the alleged 730 serial killers during the twentieth

century that sustained head injuries resulting in medical complications, 365 may have a permanent and/or irreversible impairment (Aamodt, n.d.).

Genetics

The monoamine oxidase A [MAOA] gene is suspected to cause a “genetic predisposition to violence” (Baum, 2013, para. 1). In a normally functioning gene, the MAOA enzyme chemically breaks down different neurotransmitters (e.g., dopamine, serotonin, epinephrine, and norepinephrine) so that there are not high levels of any given one in an individual’s brain (Shumay et al., 2012). This is important because these neurotransmitters are involved in the regulation of moods/emotions, response to stress, and much more. An abnormally functioning MAOA enzyme leads to a buildup of one or multiple of these neurotransmitters causing problems in the individual’s brain. The effect of abnormally high levels of neurotransmitters on behavior are why the MAOA gene has gotten the nickname ‘the warrior gene’. Defects in the MAOA gene result in high levels of dopamine, due to low turnover rates; individuals with a mutant MAOA gene are more likely to show hostile behavior than those with a wild-type gene (Subramanian, 2020). In other words, those individuals who have a lower functioning variant of the gene have a higher likelihood to have aggressive or violent behavior (Byrd & Manuck, 2014; Subramanian, 2020).

Knowledge about the role the MAOA gene plays in serial killers has led to its increased use in the criminal judicial system (Baum, 2013; Hernandez et al., 2015; McSwiggan et al., 2017). While the average individual is trying to understand the monstrous acts that they hear about in the news and on TV, experts are trying to figure out how the gene affects culpability in the justice system. The gene, so far, has been used as part of the defense in the United States and

in Italy in various stages of the legal process (Baum, 2013; McSwiggan et al., 2017). Of the eleven total cases where the evidence was seen as relevant enough to be admissible in the court, one case contributed to a lesser charge (e.g., a charge of murder being reduced to manslaughter); four cases contributed to a lesser sentence (e.g., instead of being given maximum sentence an individual got either the average or the minimum sentence during the original sentencing hearing); and two cases contributed to a post-conviction sentence reduction (McSwiggan et al., 2017). In this sense, regardless of when the evidence related to the MAOA gene is introduced and deemed relevant by a judge or jury, it ultimately leads to the individual serving a shorter sentence.

Serial killers are a national crisis that affects the lives of many. This study aims to analyze the relationship between childhood abuse serial killers suffered (e.g., physical, psychological / emotional, sexual, neglect), biology (e.g., traumatic brain injury and genetics) that these individuals had, and the number of victims they ended up killing during a specific time period (1970-1999). This potential relationship and/or connection is important to explore because: (1) being subjected to childhood abuse can increase an individual's probability of acting out or even taking inappropriate risks as an adult and (2) being born with a genetic deficiency and/or being subjected to trauma that can permanently alter brain function. Both of these are major risk factors, if not dealt with at the time, in becoming a serial killer.

Literature Review

This study involves the factors of childhood abuse status and level, head injury, and genetics as ways of interpreting the number of victims serial killers had. These factors can be broken down into three parts. Part one is the historical context of serial killers and involves development in media and trends in the United States. Part two is biology and involves development of brain damage and trends in MAOA gene. Part three is the connection between them and involves past childhood abuse/serial killing and biological factors/serial killing.

Part I: History

Development of Serial Killing in Media in the United States

Scientists, officials, and the average public individual did not fully pay attention to serial killers until the 1900s (Vronsky, 2021). At that time, serial killings became more well known because of the rise of mass media - specifically, television. Although televisions were in some homes in the 1940s, they were not commonly found in homes until the 1950s and 1960s (Briggs & Burke, 2005). During the late twentieth century, television networks were focused on keeping current viewers and attracting new ones. Therefore, television news stories covered what they thought would grab everyone's attention — serial killers (Wiest, 2016). This increased news coverage leads to many possible outcomes. The most notable ones being the serial killers wanting to stay anonymous that way they can have the 'best of both worlds' by living a double life and the serial killers wanting to risk everything to get the attention, recognition, or validation for their 'work'. Those that chose the second option would do almost anything, including but not limited to, calling or messaging either the police or news or both to: take credit, cause chaos among the public, or taunt investigators in the case (Bonn, 2018). As a result, there was more

hysteria from the public based on their perceived connection between killers and monsters (Glassner, 2000; Hodgkinson et al., 2017), more content for the network stations to air (Wiest, 2016), and more attention for the killers (Levin, 2008).

During the serial killer epidemic (1970-1999), governmental and other agencies improved their ability to combat and catch those committing the serial killings. Osowski (2018) acknowledged that they learned to form or improve their divisions associated with violent crime and to collaborate with one another. The Federal Bureau of Investigation [FBI], specifically, did three major things that affected the way they and other agencies are able to deal with crimes such as these when they occur. First, in 1972, the FBI formed a unit originally called the Behavioral Science Unit [BSU] that was later renamed the Behavioral Analysis Unit [BAU]. The main goal of this unit is to solve crimes related to one of five areas (i.e., counterterrorism, cyber crime / corruption, crimes against children, crimes against adults, and research (FBI, 2022)) by taking into consideration the ‘psychological science’ of the perpetrator (MacMillan, 2017). They specialize in analyzing more of the mental side of the crime in order to try and gain a new understanding of whatever case is at hand. Second, in 1984, the FBI created the National Center for the Analysis of Violent Crimes [NCAVC]. The main goal of this department is to assist law enforcement agencies with their “serious, unsolved violent crimes of a psychopathological nature” (Webster, 1983). These could be new, active, or cold cases. The important part is, like the BAU, the NCAVC uses psychological science as a means of solving crimes that might otherwise go unsolved. Third, in 1985, the FBI introduced the Violent Criminal Apprehension Program [ViCAP]. The main goal of this database is to allow agencies to connect and share details about their cases across the jurisdictional lines (Otto, 1986; Webster, 1983). It is normally used with the unsolved or cold cases as a way of trying to get a new lead; however, it can be used for any case

as a way to make sure that the current or future serial perpetrators (e.g., killers, arsonists, rapists, etc.) do not get away with what they have done. Together, the BSU, NCAVC, and ViCAP are vital tools that are used by various law enforcement agencies to not only catch those responsible, but also improve their training and skills in solving crimes, including those involving serial killings, in the process.

Historical Serial Killer Trends in the United States

In the United States, the number of serial killers and serial killings oscillated during the 1900s. Serial killings, based on the FBI's definition of a serial killer (FBI, 2010), were generally level during the early- to mid- 1900s (Vronsky, 2021). The number of serial killers escalated during the mid- to late- 1900s, reaching a peak between 1979 and 1987 (Aamodt, 2016; Vronsky, 2021). The number of serial killers last peaked in 1994 (Aamodt, 2016). Since then, the number of serial killers has decreased (Aamodt, 2016). In fact, the number of serial killers today is roughly a half to a third of what it was in 1994 (Čirjak, 2021). This is based on the number of known or caught serial killers being less than what it was before; it is not based on the number of unknown killers for obvious reasons.

To accurately portray serial killers, it is crucial to understand how they come to be. Factors that influence an individual's likelihood of becoming a serial killer include having low self-esteem, being raised in an abusive household, and having grown up committing petty crimes (Andreu, 2004). Other factors that have been identified include the tendency to act rashly and out of anger, as well as the overall tendency to be violent (Holmes & DeBurger, 1998; Mitchell & Aamodt, 2005). It has also been noted that, demographically, anyone can be a serial killer. It has also been noted that, in the United States, male killers vastly outnumber the females by 81.6%

(Aamodt, 2016). It has been noted that there is no generic profile of a serial killer; however, white males, of any age, were more likely to be a serial killer than anyone else (Aamodt, 2016).

Part II: Biology

Development of Brain Damage and Head Injuries

Brain damage involves more than the initial head injury (Kraus et al., 1984; Ronca et al., 2016). While the initial head injury is a contributing factor, it also acts as the catalyst for much more to come. Scientists, researchers, and the average public did not fully realize this; however, they are starting to now. Kraus et al. (1984) and Emanuelson & Wendt (1997) both studied populations to see the effects that brain damage had on these individuals. Kraus et al. (1984) used residents of San Diego, California to study its implications on their future lives. Emanuelson & Wendt (1997) studied children of Sweden who had been characterized as having a traumatic brain injury [TBI] to investigate the recovery timeline and subsequent functional impairment.

Because of all this, it is safe to say that head injuries have the potential to permanently alter an individual's brain. One of the more severe complications that can occur with brain injuries leads to “cognitive, sensory, or motor deficits” that can in turn “manifest as emotional instability” (Ronca, 2016, para. 1). In other words, there is a correlation between brain damage and emotional instabilities such as anger. This is because no injury ever fully heals (Emanuelson & Wendt, 1997; Kraus et al., 1984). For example, new neural connections could form when the old ones are damaged (Fallon, 2014). Or misfirings might occur as the brain is trying to heal from the cellular damage / death. It could even be as ‘simple’ as acting differently than what was considered their baseline ‘normal’ before (Fallon, 2014).

MAOA Gene Trends

The MAOA gene, aka the warrior gene, is located on the short arm (p) of the X chromosome (McSwiggan et al., 2017). It is responsible for the breakdown of different neurotransmitters including, but not limited to, serotonin, epinephrine, and dopamine (Baum, 2013; Subramanian, 2020). There can be more active or less active forms of the gene. The high activity form causes a quicker breakdown of the neurotransmitters leading to there being less of them in the brain at any given time; whereas, the low activity form causes a build up of neurotransmitters in the brain (McSwiggan et al., 2017). The low activity forms have been suspected to cause increased levels of aggression and/or violence which could potentially lead to individuals having a ‘genetic predisposition to violence’ (Baum, 2013; Byrd & Manuck, 2014; Subramanian, 2020).

The MAOA gene not only has an effect on ‘predisposition to violence’, but also affects criminal proceedings (Baum, 2013; McSwiggan et al., 2017). Since 1995, it has been used in the cases of eleven defendants in the United States and Italy (Baum, 2013; McSwiggan et al., 2017). The circumstances surrounding each of these cases were different; however, they ultimately led to the defendant(s) serving a shortened sentence because the judge and/or jury thought that their MAOA gene played a role in their crime(s). The success of including arguments for the role of the MAOA gene on an individual’s behavior has led to this type of ‘defense’ becoming more common (Hernandez et al., 2015). We might be seeing more of this evidence in the courts as defendants try to ‘explain away’ their actions in order to lessen the consequences.

Research on Connection Between Past Childhood Abuse and Serial Killing

In addition to the role of nature (described in the first part of the study), it is also important to examine connections between an individual's abuse during childhood and their status as a serial killer. Serial killers are more likely to have been physically (36%), sexually (26%), and/or psychologically (50%) abused when they were children (Mitchell & Aamodt, 2005; Marono et al., 2020). Approximately two out of three children are adversely affected by their exposure to violence (Listenbee et al., 2012). The level of abuse they suffer can affect their interactions with their victims. Individuals who were sexually abused are less likely to take a long time to kill their victims or do it in an 'overkill' fashion (i.e., more force than is necessary to cause death) than someone that was physically or psychologically abused (Marono et al., 2020). Many studies have been conducted to try to understand why serial killers continue to feel the urge to kill others. Violence in childhood is associated with an individual's increased likelihood to be angry or to commit crimes as an adult (Listenbee et al., 2012; Marono et al., 2020; Mitchell & Aamodt, 2005). Social interaction can influence a serial killer's ability to keep killing under the radar ('Ranker', 2019). It has been proposed that serial killers who become empowered and take more chances are more likely to get caught (FBI, 2010). Conversely, those that can survive without recognition / validation are more likely to get away with what they are doing; at least for a little bit longer (Lee & Reid, 2018; Simon, 2015).

Some research analyzed components of serial killer's lives (e.g., homelife, upbringing, schooling, etc.) as a way to understand and possibly stop some of them in the future. One such study used cases from the Miami Police Department and found that serial killers tend to "know absolutely nothing about the person who is to become their victim" (Andreu, 2004, para. 1). Once they get their victim the way they want, they generally start doing whatever their mind

thinks of doing to them; as if they are on ‘autopilot’. Additional studies investigated the effect of when violence in childhood occurs, found that early intervention for victims of childhood abuse led to their being more successful in life and being less likely to hurt others (Marono et al., 2020; Maxfield & Windom, 1996). Moreover, the extent to which they experience violence as children influences their delinquency or criminality more than whether or not they were abused (Maxfield & Windom, 1996).

Research on Connection Between Biology and Serial Killing

Given the known effect of biological factors and abuse on an individual’s criminal tendencies, it is important to examine past research that analyzes any connection between an individual’s genetics (i.e., the MAOA gene) and brain physiology (due to past head injury / brain damage) with their status as a serial killer. When comparing a sample of serial killers to their younger selves, it was found that they all were involved in acts of violence in their childhood (Lewis et al., 1985). Further noted was that four of them were found to have childhoods that were ‘extraordinarily violent’. This begs the following questions: Why did they do what they did? What was built into their DNA or brain that made them predisposed to the violence? Raine (2014) answers this saying that serial killers had “impairments to brain areas controlling [their] ability to experience fear, make good decisions, and feel guilt predispos[ing them] to violence”.

Some research, looking into the possible role of nature and nurture, found that a serial killer’s biology does not define their destiny (Raine, 2014). However, it is a component that, when combined with other factors, can make someone tick causing irreversible damage for others. Additional studies investigated how all the components actually work together (Clemente, 2019; Hernandez et al., 2015; Lewis et al., 1985). Jim Clemente, a former

Supervisory Special Agent [SSA] and profiler with the BAU within the FBI, did an interview in 2019 that corroborates early findings by both Lewis et al. (1985) and Hernandez et al. (2015) by suggesting that serial killers are living breathing murder weapons. He says that “genetics loads the gun, personality and psychology aim it, and your experiences pull the trigger. Your genetics give you the potentiality to be a killer, but your personality and psychology are the filter through which you experience, and they can shade how you come away from any event in your life” (Clemente, 2019, 0:07-00:14). This had been previously suggested by Marsha M. Linehan’s 1993 BioSocial Theory or George Engel’s 1977 BioPsychoSocial Theory.

The preceding review of literature demonstrates that the topic of serial killers and their possible relationship to either an individual’s past childhood abuse or biological history (past head injury and MAOA gene) is an important topic. Questions, however, still remain about their potential connection. The present study aims to examine these relationships further.

Methods

The literature review shows that the question of the relationship between whether or not childhood abuse, head injuries, and the number of their victims is important. This study aims to further examine this relationship. Secondary data analysis, when the researcher uses data collected by other researchers for a different purpose, will be used to address both of the independent variables (general abuse status, level of abuse, and head injury) and the dependent variable (number of victims). The study uses data collected by Dr. Michael Aamodt, a noted expert with multiple publications and presentations on serial killers, and his students at Radford University (Aamodt, n.d.). The qualitative data was compiled in timelines for 199 different serial killers. Of which, 154 fit the US serial killer definition and 107 fit the time period of interest.

Part I: Childhood Abuse

Child abuse is the the maltreatment of an individual under the age of eighteen (Simpson & Weiner [Oxford], 1989b). It can be categorized into four types: physical, sexual, psychological, and neglect (Mitchell & Aamodt, 2005). Using data presented in the Serial Killer Timelines (Aamodt, n.d.), the abuse is operationalized as follows:

- a) Whether they were abused as children

0 if they were not abused

1 if they were abused

- b) A tiered ranking of the level of abuse that they faced

Tier 1 for those that experienced one kind of abuse

Tier 2 for those that experienced two kinds of abuse

Tier 3 for those that experienced three or more kinds of abuse

Part II: Head Injuries

This part of the study conceptualizes the independent variable of brain damage as the functional alteration and/or impairment that results from a physical injury (Simpson & Weiner [Oxford], 1989a). The physical injury, in this case, can be operationalized as to whether they experienced head injuries:

0 for no head injury

1 for at least one head injury

Serial killer victims are defined as those individuals who were killed as a result of the actions of serial killers. In turn, according to the Protection of Children from Sexual Predators Act of 1998, serial killers are defined as those who commit “a series of three or more killings, not less than one of which was committed within the United States, having common characteristics such as to suggest the reasonable possibility that the crimes were committed by the same actor or actors” (FBI, 2010; H.R.3494, 1998, p. 14). In this study, the number of victims is compiled from the Serial Killer Timelines (Aamodt, n.d.).

Factorial ANOVAs are used to compare the different independent variables (serial killer’s childhood abuse (in general and levels) and head injuries) with each other and with the dependent variable (number of their victims) to see what, if anything, was significant.

The independent variables in this research study are childhood abuse status / level and head injury. The abuse status and head injury are operationalized as a dichotomous variable, meaning that they both only have two variations of them; the level of abuse is operationalized as an ordinal variable, meaning that it has more than two variations of it. Univariate statistics appropriate for such variables are the mode because it says which variation of childhood abuse status / level and head injury appears more often than the other. The dependent variable is the number of victims the individual killed (once they were identified as a serial killer) and it is operationalized as a continuous variable, meaning that there is no set beginning / ending amount. Univariate statistics appropriate for such a variable are the mean and standard deviation. The results of the univariate analysis on the variables can be found below.

Predictions

For this study, although there were only two independent variables and one dependent variable, the variations among them and the interaction between them led to there being five different predictions. The first three deal with the independent variables and their individual effect on the dependent variable. The last two deal with the interaction among independent variables and their combined effect on the dependent variable. (1) Abuse will have an effect on the number of victims. With a serial killer having been abused, the number of their victims will be higher than those that experienced no abuse. (2) The level of abuse experienced will have an effect on the number of victims. The more the serial killer experienced in terms of level of abuse; the higher the number of their victims will be than those that experienced a lesser level of abuse. (3) Head injury and brain damage will have an effect on the number of victims. With a serial killer having at least one past injury present, the number of their victims will be higher than

when no head injury is present. (4) The combination of abuse and head injury will have an interactive effect on the number of victims. Serial killers who experienced abuse and experienced at least one head injury will have a higher number of victims than those that either only experienced abuse or only experienced a head injury. (5) The combination of level of abuse and head injury will have an interactive effect on the number of victims. Serial killers who experienced three kinds of abuse and a head injury will have a higher number of victims than those that experienced two kinds or one kind of abuse and a head injury.

The predictions were based on past research done by multiple individuals that suggest the relationship between the abuse, head injury, and number of victims. For abuse, it was suggested that experiencing childhood abuse or other sorts of violence led to individuals having an increased likelihood for anger and/or crime as an adult (Listenbee et al., 2018; Marono et al., 2020; Mitchell and Aamodt, 2005). For level of abuse, it was suggested that experiencing multiple kinds of violence as a child led to individuals being adversely affected and lashing out (Listenbee et al., 2012). For head injury, it was suggested that experiencing a head initial injury is about more than the initial injury; there are long lasting effects that affect recovery time and behavioral changes afterwards (Emanuelson and Wendt, 1997; Kraus et al., 1984; Ronca et al., 2016). For interaction between abuse / level of abuse and head injury, it stems to reason that those who experience abuse and head injury have a compounding nature to them because the individual is still experiencing both of them, they are just piled on top of one another potentially making the individual effects more drastic.

Results

The literature review showed that it is important to know more about the possible connection between an individual's past childhood abuse, head injury, and the number of their victims. This study aims to explore these connection(s) via secondary statistical analysis. This research study performs a two-part analysis, each with subparts. Part I involves all the variables (childhood abuse status / level, head injury, and the number of victims) together. First, an overall 2 (head injury or not) x 2 (abuse occurred or not) multivariate Analysis of Variance [ANOVA] explored the possible connection between abuse status and head injury. Second, a 3 (level of abuse: severe, moderate, mild) x 2 (head injury present or not) multivariate ANOVA was used to explore the possible connection between level of abuse and head injury. Part II involves the independent variables (childhood abuse status / level and head injury) separately in relation to the number of victims. First, one-way ANOVAs are used to explore the connection between each independent variable and the dependent variable. This was done in terms of F score, degrees of freedom and p-values. Second, descriptive statistics are used to explore how the independent variables affect the mean, standard deviation, and range in terms of number of victims.

Overall connection between variables

The factorial ANOVA between abuse status and head injury (Table 1) showed that there was not a significant difference between the variables ($F(1, 103) = 0.016, p = 0.899$) nor each independent variable on the number of victims ($p = 0.547$ and $p = 0.217$, respectively). The factorial ANOVA between level of abuse and head injury (Table 2) showed that there was not a significant difference between the variables ($F(3, 99) = 1.168, p = 0.326$) nor each independent variable on the number of victims ($p = 0.094$ and 0.924 , respectively). It is important to note that,

while none of the variables or their interactions were found to be significant at the $p < 0.05$ level, the head injury component appears to be a driving factor.

Connection between each variable separately

The resulting F scores, 1.084 for abuse status, 0.412 for level of abuse, and 2.959 for head injury, suggest that there is variation between the two conditions for abuse status and head injury and the three conditions for the level of abuse (Table 3). However, the results were statistically insignificant ($p = 0.300, 0.745, \text{ and } 0.088$, respectively) at the $p < 0.05$ level. The implications of these results are discussed in the following section.

An appropriate multivariate test was performed to further analyze the effect of the independent variables on the mean number of victims. The mean difference in the number of victims, which was calculated in the absolute value of the difference between the number of victims, from abused versus non-abused serial killers is roughly 2.0, for level of abuse is roughly ± 1.0 , and for head injury versus no head injury is roughly 4.0 (Table 4). The expanded version of this, as an interaction between variables, shows the difference in mean number of victims along with their range and subsequent standard deviation (Table 5). Those serial killers with head injuries had a mean number of victims that were 1.5 almost 2 times that of non head injured killers.

Discussion

The statement of the problem and literature review sections of this study covered the harms, both personal and general, of serial killing on society. It is important to understand the effect of an individual's past childhood abuse or prior head injury, on their behavior and actions as an adult. This study aimed to determine whether: there is a relationship between an individual's childhood abuse, their previous head injuries, and the number of a serial killer's.

Our analysis, from part one of the study, ultimately did not support a relationship between childhood abuse and number of victims. The multivariate analysis found that serial killers who were abused as children killed 2 victims more than non-abused serial killers (Table 4). However, the one-way ANOVAs (Table 3) and the factorial ANOVAs (Table 1 and 2), which looked at several more narrow categories, found that neither abuse in general or level of abuse faced by serial killers had an effect on the number of victims (Table 3, $p = 0.300$ and $p = 0.745$; Table 1 and 2, $p = 0.547$ and 0.924). Those serial killers who faced two kinds of abuse had more victims (mean was roughly 12.0 victims) than those that faced one kind of abuse (mean was 10.0) or three plus kinds of abuse (mean was roughly 11 victims (Table 5)). This allows the null hypothesis, in the end, to be accepted for whether general abuse or level of abuse play a role in the number of victims.

Our analysis, from part two of the study, ultimately did not support a relationship between head injuries and number of victims. The multivariate analysis (Tables 4) found that serial killers who suffered from head injuries as a child had killed 4 victims more than non-head injured serial killers (Table 4). Interestingly, the one one-way ANOVAs (Table 3) and two-way ANOVAs, aka factorial ANOVAs (Tables 1 and 2), which looked at the effect of two independent variables on one dependent variable, found that head injuries ($p = 0.088$, $p = 0.217$,

and $p = 0.093$) nor the combination of either the general abuse status and head injury or level of abuse, for those serial killers that were abused, and head injury faced had an effect on the number of a serial killer's victims ($p = 0.899$ and 0.326 respectively). We can accept the null hypothesis for whether the combination of abuse and head injury play a role in the number of victims. We can also accept the null hypothesis, on a statistical not realistic/practical level, whether head injuries play a role in the number of a serial killer's victims.

This research had several limitations. First, it only looked at 107 serial killers. This was unavoidable due to the lack of existing data, but it limits the study all the same. Next, there are many factors that could have an impact on the number of victims; this study only examined whether the killer was abused or suffered a head injury as a child. Lastly, this study focused on a smaller subgroup of US serial killers from a thirty-year time period which is not the most current (1970-1999).

Future research on this topic should make the following improvements. First, it should look at a larger sample of serial killers from various reputable sources. Second, it should examine the effect of other variables on the number of victims. Third, one could examine either US serial killers acts over a longer and more recent period of time or they could examine serial killers from multiple countries.

Despite its limitations, the present study found evidence that serial killers who were abused or suffered at least one head injury as a child do have more victims. However, the study did not find evidence that either independent variable or the combination of abuse and head injury or the level of abuse and head injury resulted in a significantly higher number of victims.

These important findings could be the basis of efforts to bring down the number of serial killer victims by fighting abuse as a whole, not the extent to which individuals were exposed to it, and the head injuries associated with it.

Tables

Table 1. Descriptive statistics of source of variance by general abuse status and head injury

Source of Variance	df	F	Significance
Corrected Model	3	1.122	0.344
Abuse (n = 41, 66) ^a	1	0.366	0.547
Head Injury (n = 77, 30) ^b	1	1.541	0.217
Interaction	1	0.016	0.899
Error	103		

^a 41 serial killers experienced no kind of abuse and 66 serial killers experienced some kind of abuse.

^b 77 serial killers had no head injuries and 30 serial killers had at least one substantial head injury.

Table 2. Descriptive statistics of source of variance by level of abuse and head injury

Source of Variance	df	F	Significance
Corrected Model	7	0.980	0.450
Level of abuse (n = 41, 23, 25, 18) ^a	3	0.158	0.924
Head Injury (n = 77, 30) ^b	1	2.879	0.093
Interaction	3	1.168	0.326
Error	99		

^a 41 serial killers experienced no kind of abuse, 23 serial killers experienced one kind of abuse, 25 serial killers experienced two kinds of abuse, and 18 serial killers experienced three plus kinds of abuse.

^b 77 serial killers had no head injuries and 30 serial killers had at least one substantial head injury.

Table 3. Analysis of variance results

Source of Variance	df	F score	Significance
Abuse	1	1.084	0.300
Level of Abuse	3	0.412	0.745
Head Injury	1	2.959	0.088

Table 4. Multivariate analysis on individual's childhood abuse status / level, head injury and the number of their victims

Variable	Mean Difference ^a
Abuse status	2.0
Level of abuse	1.0
Head injury	4.0

^a Number of victims rounded to the nearest whole number

Table 5. Descriptive statistics of mean number of victims by serial killer's childhood abuse status / level and head injury

Status, Level, Head ^a	Mean ^b	Standard Deviation ^c	Range
0, 0, 0 (n = 35)	9.0	6.7	32.0
0, 0, 1 (n = 6)	11.0	9.2	24.0
1, 1, 0 (n = 18)	9.0	7.7	24.0
1, 1, 1 (n = 5)	15.0	18.5	44.0
1, 2, 0 (n = 14)	12.0	13.4	51.0
1, 2, 1 (n = 11)	10.0	9.9	33.0
1, 3, 0 (n = 10)	7.0	4.2	10.0
1, 3, 1 (n = 8)	16.0	15.9	45.0

^a Abuse status: 0 for no and 1 for yes. Level of abuse: 0 for no, 1 for 1 kind of abuse, 2 for 2 kinds of abuse, and 3 for 3+ kinds of abuse. Head injury: 0 for no and 1 for yes.

^b Number of victims rounded to the nearest whole number

^c Number of victims rounded to the nearest tenth

Appendix: Case Studies involving the variables discussed in this study

As discussed before, the MAOA gene is an interesting one to be studied by itself, but it is also interesting to study the potential effects of it on individuals and their decisions. Below are four individuals who were suspected to have a low functioning variant of the MAOA gene [MAOA-L], which might have played a role in them committing the heinous acts that they did. Each of them has evidence indicating a different interaction between the independent variables (1 none at all, 1 abuse only, 1 head injury only, and 1 both abuse and head injury).

Theodore Robert Cowell aka Ted Bundy

He came from a seemingly normal family with a secret; his sister was really his mother and his mother was really his grandmother (Hernandez et al., 2015). He was told this truth when he was 13 and found out for sure when he was 22. Although he seemed to be intrigued with knives when he was just 3 and he was suspected of petty crimes (e.g., stealing things, watching over others) when he was a teenager, he did not officially start his criminal career or his murderous career until he was 27 (Aamodt, n.d.). At this point there was no stopping him. In a span of about six years, he had abducted, raped, and brutally murdered 36 women in six different states by beating them to death (Aamodt, n.d.). He is suspected of many more, but these are those that are confirmed as ‘his kills’.

This begs the question of ‘how is all of this brutality possible if he was not abused and if he did not suffer a single head injury?’ Scholars have come to the conclusion that he might have had MAOA-L (Hernandez et al., 2015). They are attributing his psychological problems and violent thoughts from his childhood to this. They are also suggesting that he was able to keep this

side of himself hidden until he experienced his stressor with his former girlfriend, Stephanie Brooks (Hernandez et al., 2015). After that, there was no keeping the aggression or violent behavior hidden anymore.

Jeffrey Dahmer aka Milwaukee Cannibal

His childhood was abnormal at best. The only seeming normal part of it was when he was a stereotypical toddler that was playing with toys and constantly getting sick in some capacity. After this point and the family move to Iowa, he took a turn to his true self. His true self that, at the age of 4 was thrilled by the sound that the remains of small animals made, at the age of 8 drowned tadpoles with motor oil and experiment with animals using a chemistry set, and at the age of 10 collected road-kill as a way to examine different parts of the animal bodies (Aamodt, n.d.). He continued to do various odd stings in his free time until he was 18. At this point, he turned from dealing with small animals to dealing with human beings. He ended up getting drunk, having sex with, killing, and dismembering a hitchhiker. This overall pattern, with some small variations, continued from ages 18 to 31 where he ended up killing 16 men (Aamodt, n.d.).

Given the history of psychological and sexual abuse that he experienced, one might think that he was 'destined' for a life that involved crime. They, however, might not think that it would result in something like what it actually was unless something else was also a factor. This is where MAOA-L comes in. When coupled with an individual's environment and/or their upbringing, scholars have suggested that MAOA-L can increase their likelihood of having psychopathic features (Williams et al., 2009).

Randy Kraft aka Score-Card Killer or Freeway Killer

He came from a caring family. He was excellent in school having high grades all throughout his childhood and graduating tenth in his high school class (Aamodt, n.d.). He never made a fuse or was in trouble. He was seen as the good child that most parents wanted. If only they knew, at that time, what he would grow up to become. In 1969, he was discharged from the air force for what they deemed ‘medical reasons’, he stopped talking to his family, and he told a friend that “there’s a part of me that you will never know” (Newton, n.d., para. 5). A year later, at the age of 25, he killed his first known victim and at the age of 33 he killed his last. During these eight years, he burned, strangled, even occasionally dismembered 16 people (Aamodt, n.d.). These were the only ones that the police could connect him to. They actually suspect that he killed almost four times as many people; they just could not prove it.

With his childhood appearing the way it does, it comes at a shock that he committed the acts that he did. The only thing that was slightly off was that he was accident prone (e.g., he fell down a flight of stairs, hit his head, and was knocked unconscious (Aamodt, n.d.)). In his trial, a positron emission tomography [PET] scan was entered into evidence showing that he suffered from an abnormality that could affect his behavior in many ways including emotionally and sexually (Hicks, 1989; Tancredi & Brodie, 2007). The doctor that testified to the scan said that “the problem could stem from a head injury Kraft suffered when he was 1 year old” (Hicks, 1989, p. 2). What they did not know at that time was that PET scans could be used to find the MAOA gene or the lack thereof in an individual’s brain (Fowler, 2005).

John Wayne Gacy aka The Killer Clown

His childhood was awful (Aamodt, n.d.). He watched his father hurt his mother when he was 2. He watched his father shoot his dog when he was 6. He was beaten by his father from the age of 4 until the age of 17. He has a string of health complications throughout his childhood. In the midst of all of this, he began acting out and committing petty crimes, mainly theft of underwear. It was not until he was 19 that he started experimenting with both the living and the dead. This, along with the family that he was building, seemed to hold him over for a couple of years until his daughter was born and he began molesting boys (Aamodt, n.d.). At this point, it was only a matter of four years before his killing started. During the six-year killing period, he sexually assaulted, tortured, killed, and disposed of 33 boys and men (Mensah, 2022).

Given the history of all forms of abuse (physical, psychological, sexual) that he experienced and the residual effects of both the blood clots after being struck in the head as a child and the abuse, it is not fully surprising that he engaged in a life of crime as an adult. The easiest way to put it is that he follows James Fallon's three-step process for an individual becoming psychopathic (Fallon, 2014). First, he not only has an underdeveloped frontal cortex; he also has a damaged one. Second, he experienced, what one might call, a traumatic childhood. Finally, it is suspected that he had MAOA-L (Haycock, 2014; White, 2018). You put all three of these together and it is a perfect, terrible storm that combines the nature of his messed up brain with the nurture of his awful childhood and ended up costing a bunch of innocent individuals their lives.

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