**DEPARTMENT OF PSYCHOLOGY**

**UNIVERSITY OF GHANA**

# THE NEUROPSYCHOLOGICAL AND PSYCHOSOCIAL PREDICTORS OF JUVENILE DELINQUENCY: COMPARING DETAINED DELINQUENTS AND MATCHED CONTROL GROUP

**BY**

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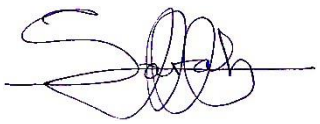
## DECLARATION

I hereby declare that, with the exception of references, which are duly acknowledged, this thesis is the result of a research conducted by Sarah Turkson under supervision and has not been presented in any form by anyone for any academic award in this university or any other.



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## DEDICATION

I thank God Almighty for His immeasurable grace and favour upon my life throughout this challenging but interesting task of writing up this thesis. To my late mum, Mrs. Veronica Mena Otuaa Turkson (May your soul find eternal rest) I am grateful for your prayers and support throughout my life and most especially during my master's degree. You were always my biggest cheerleader.

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## ABSTRACT

The causes of juvenile delinquency are varied. Research has focused largely on psychosocial factors although there is growing evidence that brain factors are equally implicated. Identifying the causes of delinquency is very important as it helps with rehabilitation of youth who are caught in the world of crime or at risk of becoming delinquent. In the present study, the objectives were to investigate broadly, psychological and social predictors of delinquency. Specifically, the objectives were to examine the extent to which selected neurocognitive abilities and psychosocial characteristics can predict delinquency. A battery of neuropsychological tests was used to collect data from 84 detained delinquents and 31 matched controls between the ages of 14 and 18 years. Using the logistic regression analysis, results indicated that poor verbal ability was a robust neuropsychological predictor of juvenile detention. In addition, low socioeconomic status more than doubled the likelihood of juvenile detention. Somatic complaints and rule breaking behavior were emotional/behavioral problems that almost doubled the likelihood of juvenile detention. Inadequate parental supervision; low parental education and childhood abuse/trauma may account for the findings. Recommendations include, extensive neuropsychological evaluations need to be included in the legal decision-making process at the juvenile courts. Prison officers should be trained on the care and management of children with neuropsychological deficits. Teachers should be trained to identify children who are at risk for delinquency, so that early interventions can be made.

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**LIST OF ABBREVIATIONS**

MCST- Modified Wisconsin Card Sorting Test

TMT- Trail Making Test

CVLT-Californian Verbal Learning Test

REY- Rey Osterrieth Complex Figure Drawing Test

KNT- Kilifi Naming Test

RPM-Raven's Standard Progressive Matrices

PC- Pair Cancellation

DS- Digit span

WD- Withdrawn/Depressed

AD- Anxious/Depressed

SC- Somatic Complaints

TP- Thought Problems

AP- Attention Problems

SP-Social problems (Relational problem)

RRB-Rule Breaking Behavior

A-Aggression

SCC-Senior Correctional Centre

SES-Socioeconomic status

# CHAPTER ONE

# INTRODUCTION

## Background of the study

Generally, juvenile delinquency refers to illegal acts, whether criminal or status offences, committed by children under the age of 18 (Shoemaker, 2010; Duruji & Onyekachi, 2015). Therefore, behaviors by an individual under the age of 18 years that violates a criminal law or status law is a delinquent act. Delinquent acts include statutory offenses such as running away from home, malingering, truancy and criminal offenses such as manslaughter, murder, theft, assault and the like (Duruji & Onyekachi, 2015). In Ghana, truancy and running away from home are not legally considered as delinquent acts (Boakye, 2013). However, delinquent acts in Ghana generally range from illegal drug possession, fraud, assault, theft and armed robbery, rape, manslaughter, murder, gang violence and others. Under the Juvenile Justice Act 2003 (Act 653), a juvenile delinquent in Ghana, is defined as an individual under the age of 18 years who offends.

Juvenile delinquency remains a global concern despite its apparent decline since the 1980s (Badiora, 2015; Junger-Tas et al., 2010). Recent statistics by Justice department in the United States, reported that approximately 2,400 juvenile arrests per 100,000 persons were made in 2018 (Office of Juvenile Justice and Delinquency Prevention, 2019). In Ghana, there seems to be a paucity of crime statistics. Notwithstanding, in 2015, an annual report by the Ghana Prison Service showed an average of 125 daily lockup (Ghana Prison Service, 2015).

Juvenile delinquency unchecked is a major source of concern because of the consequences on the individual and the nation. For the individual, consistent delinquency can lead to a gradual moral degeneration, especially when delinquency persists into adulthood. In addition, persistent engagement in delinquent acts increases the likelihood of detention, which

leads to school dropouts, social rejection, reduced academic and employment opportunities (Osei, 2013). For the nation, juvenile delinquency puts an enormous drain on human resources, in the sense that qualified labor essential for national development greatly reduces as more youth are incarcerated. Moreover, it costs government more in terms of incarceration and rehabilitation, in the sense that as more youth are incarcerated/detained more resources will be needed to rehabilitate juvenile offenders (Osei, 2013). Again, research shows that incarceration during adolescence has a negative effect on physical and mental health outcomes later in life (Barnert et al., 2017). Hence, it is crucial for lawmakers, and other stakeholders to understand the factors that lead to and maintain delinquency in order to implement early interventions, which target at-risk populations and provide psychological, educational, and other intervention regimens to reduce incarcerations and delinquency all together.

**Psychosocial risk factors of juvenile delinquency**

The exact cause of juvenile delinquency is widely debated. However, decades of research on delinquency suggests that a myriad of psychosocial factors increases the risk of juvenile delinquency. Psychosocial risk factors of delinquency refer to the social and psychological factors that increase the chance of individuals engaging in delinquency. This present study focuses on well-established psychosocial factors such as family structure, family size, socioeconomic status, emotional and behavior problems. Social factors such as bad neighborhoods, abuse, negative peer association have been strongly associated with delinquency (Abrah, 2019; McGloin & Thomas, 2019; Wrigley-Asante et al., 2016). Family factors such as poverty, parental absence, single parenting, negative peer influence, hostile family relationship, parenting styles and negative community features are directly associated with delinquency (Badiora, 2015; Balogun & Chukwumezie, 2010; Coleman, 2014; Duruji & Onyekachi, 2015; Elechi & Uriah, 2018; Ntim & Manu, 2019; Rekker et al., 2017; Shong et al., 2019).

Researchers in Ghana have found similar findings. For instance, some studies have shown that socioeconomic status (unemployment in the family, illiteracy, and poverty) are significant predictors of delinquency (Boakye 2012; Bosiakoh & Andoh, 2010). This suggests that juveniles from poor backgrounds commit crimes such as armed robbery and theft in order to provide for themselves and their families. Thus, for such individual delinquency is a means of survival. Other researchers suggest that single-parent families and poor supervision could negatively influence child development, in the sense that there may be inadequate parental control of children by one parent, which can lead to poor levels of self-control, increasing the vulnerability of children to delinquency and crime compared to children from families with both parents with better supervision (Barnie et al., 2017; Boakye, 2012; Boakye, 2013; Bosiakoh & Andoh, 2010; Darkwa & Abass, 2016; Ntim & Manu, 2019). Furthermore, poor academic performance and negative peer association associated with a disinterest in school activities leads to school dropouts, which increases the likelihood of delinquent behavior and related activities (Gyansah et al., 2015).

On the other hand, juvenile delinquency is strongly linked to behavior and emotional problems such as anti-social behavior (Connolly et al., 2016), Conduct Disorders/Oppositional Defiant Disorder, impulsivity, low intelligence (Murray & Farrington, 2010) and negative emotionality (Baglivio et al., 2017) and Depression/anxiety (Jolliffe et al., 2019). These studies imply that individual characteristics increase the vulnerability to disregard social norms and engage in criminal behavior. However, the view that social factors or psychological factors are solely responsible for delinquency may be inadequate. Advances in biological criminology, neuroimmunology, and neuropsychological research suggest that there may be some biological underpinnings associated with juvenile delinquency.

**Brain Function and delinquency**

The normal functioning of the brain has direct effects on behavioral, cognitive, and emotional outcomes of both adults and children (Semrud-Clikeman & Ellison, 2009). Abnormal functioning of the frontal lobes, temporal lobes, in particular, the amygdala, hippocampus, and the anterior cingulate cortex, are implicated in the development of criminal behavior (Ling et al., 2019). The frontal lobe is a part of the cerebral cortex located near the front of the head. Generally, this brain structure is responsible for motor coordination, expressive language, higher-order functions such as sustaining attention, abstract reasoning, goal formulation, planning, inhibiting inappropriate behaviors and adaptive shifting to alternate behaviors (Ling et al., 2019). The frontal lobes also have rich connections with several other brain structures and so damage to the frontal lobes or those connections can compromise important functions such as executive functions and other aspects of cognition such as learning, memory, and attention as well as behavioral competencies mediated by the frontal lobes (Lengenfelder et al., 2015).

Brain-imaging research has shown that a reduced frontal lobe functioning is the most consistent correlate of abnormal brain function and criminal behaviors (Glenn & Raine, 2014). Further imaging studies has revealed that the largest reductions of grey matter in the frontal lobes of criminal individuals occurs in the dorsolateral prefrontal cortex and orbitofrontal cortex, as well as the anterior cingulate cortex (Glenn & Raine, 2014; Young & Raine, 2009). The dorsolateral prefrontal cortex, a sub-structure of the pre-frontal cortex, is associated with self-regulatory processes such as attention, cognitive flexibility, inhibition and perhaps antisocial characteristics such as impulsiveness (Glenn & Raine, 2014). Individuals with abnormal functioning of this brain structure are more likely to persist in wrong behaviors even when they are punished for such behaviors.

The orbitofrontal cortex, another sub-structure of the pre-frontal cortex, plays a role in the processing of emotions, decision-making and learning from punishments and rewards (Blair, 2004; Glenn & Raine, 2014). Thus, individuals with damage to this brain structure will have difficulties processing emotions and may be unable to determine the social and situational appropriateness of behavior. The anterior cingulate cortex, is involved in controlling attention to a particular task, decision-making, error processing, conflict monitoring, and avoidance learning (Glenn & Raine, 2014; Stevens et al., 2011). This means that a normal functioning anterior cingulate cortex enables people recognize and correct mistakes and appropriately respond to conflicting situations, particularly because of those connections to both the limbic system and the prefrontal cortex (Adjorlolo & Egbenya, 2016; Stevens et al., 2011). Thus, damage to this area of the brain could result in disinhibition, aggression, poor decision-making and impaired emotional processing (Glenn & Raine, 2014; Stevens et al., 2011).

**Neuropsychological functions and delinquency.**

Neuropsychological functions usually refer to a broad range of cognitive, emotional and behavioral processes associated with abnormal brain functions (DeLisi & Vaughn, 2011; Jackson & Beaver, 2016). Juvenile delinquents are especially prone to brain injury because of their risk of exposure to violence or violent situations. According to Fabian (2010), impaired neuropsychological functions such as executive functions, verbal and language abilities, attention, memory, decision-making, inhibition of inappropriate behaviors, academic achievement, intelligence, and self-control, increases the risk of criminal behavior such as juvenile offending and incarceration. This current study focuses on neurocognitive function domains such as, executive functions, attention, memory, and verbal ability predictive of juvenile delinquency, by comparing juveniles in detention with regular school going children.

Executive functions are a group of higher-order cognitive processes that involve planning and organization, cognitive flexibility, response inhibition, working memory, attention, self-regulation and purposive goal-oriented behaviors (Delgado-Mejía & Etchepareborda, 2013; Shoemaker et al., 2013). Executive functions develop slowly from infancy through adolescence into adulthood (Henry & Bettenay, 2010; Kramers-Olen, 2015; Thornberry et al., 2013) and they are important for success in everyday life in general; physical and mental health; success in school; social and psychological growth and well-being (Rabinovici et al., 2015). Executive functions are one of the most consistent neuropsychological functions impaired among juvenile delinquents.

Juveniles with impaired executive functions will most likely have poor cognitive, and behavioral control, which manifests as breaking rules, aggression, poor decision-making, and delinquency (Monahan et al, 2015). Research has found that deficits in executive functions are significantly associated with general delinquency (Baglivio et al., 2015; Burton et al., 2016; Muscatello et al., 2014; Seruca & Silva, 2016; Wallinius et al., 2019; Zou et al., 2013). In addition, these researchers suggest that juvenile delinquents show the greatest executive function impairments in inhibition, planning, cognitive flexibility, and working memory compared to normal controls. Inhibition is the ability to ignore impulses or inappropriate behavior. Cognitive flexibility, or set shifting has to do with the ability to modify attention and behavior in response to changing situations (Rabinovici et al, 2015). Working memory is the ability to remember information relevant to successful completion of a particular task (Sukyirun, 2016). Planning has to do with the use of efficient strategies to accomplish a goal. Thus, impaired executive functions in these areas explains why juvenile delinquents are unable to recognize future consequences in decision-making, unable to control undesirable emotions and behavior and unable to correctly process social cues. In addition, differences in impaired

executive functions have been found among offender groups (Adjorlolo & Egbenya, 2016; Seruca & Silva, 2016; Zou et al., 2013).

Another neuropsychological function impaired among juvenile delinquents is attention. Attention includes the capacity to selectively attend to specific information, to alternate attention among two or more stimuli and to sustain attention for a particular period (Semrud-Clikeman & Ellison, 2009). Generally, impaired attention indicates low self-control (Hoffmann, 2018) and lower levels of self-control has been linked to antisocial outcomes including juvenile delinquency. In children, impaired attention is linked to poor academic performance, poor social interactions and other behavioral problems (Ling-Teo & Jiar-Yeo, 2017). Impairments in one or more areas of attention have been found among juvenile delinquents (Hoffman, 2018). Juvenile delinquents have a higher occurrence of attention hyperactivity disorder (ADHD) compared to the general population (Borrani et al., 2019). This suggests that juvenile delinquents evince a diminished attention capacity. Moreover, researchers report that children with ADHD show more aggression (Falk et al., 2017) which indicates a possible link between impaired attention and behavior problems.

Sustained attention involves maintaining focus and correctly responding to a task for a prolonged period even in the presence of distracting stimuli. It is reported that individuals with poor sustained attention have more behavior problems and attachment than individuals without sustained attention deficits (Borrani, 2011; Low & Webster, 2016). Specifically, among juvenile delinquents, sustained attention was found to be a moderating variable between verbal intelligence, academic achievement and delinquency (Steinmayr et al, 2010; Borrani, 2011; Hoffman, 2018). This suggests that lower levels of sustained attention affect success in school to a certain degree, which in turn leads to poor academic achievement, making juveniles susceptible to deviance and criminal behavior.

Attention and memory generally go hand in hand, in that one cannot demonstrate a good memory without paying attention to information. Memory is one of the most basic cognitive processes and generally it refers to the capacity to encode, store and retrieve information for later use (Borrani et al., 2019). There are various forms of memory, including but not limited to working memory, verbal memory, visual memory, short-term memory and long-term memory. Working memory refers to the capacity to recall relevant information for a particular task (Borrani et al., 2019). Impaired working memory is linked to antisocial behavior, sexual violence and general delinquency. Research reports that juvenile delinquents, especially violent juvenile delinquents and sexual violent delinquents have impaired working memory, manifested by their consistently poor performance on memory tasks (Burton et al., 2016; Sukyirun, 2016; Yoder et al., 2019).

Verbal memory involves recall for verbally presented stimulus. Visual spatial memory refers to the capacity to recall shapes and figures and their location. Short-term memory is the capacity to retain a limited amount of information for a short period, usually from a few seconds to a few days (Crowder & Carbone, 2011; Vallar, 2017). On the contrary, long-term memory involves the capacity to hold information indefinitely. Indeed, deficits in memory have been linked to general delinquency and specific types of offending such as sexual offending (Burton et al., 2016; Yonder et al., 2019). Individuals, who begin antisocial behavior early during childhood, have deficits in verbal learning and memory (Johnson et al., 2015). Moreover, research has found that short-term verbal memory impairments are linked to language difficulties and poor academic performance (Baird et al., 2010; Swanson et al., 2012). In addition, research has found that working memory impairments affect decision-making and increases the risk of offending among juvenile delinquents (Fields, 2017; Syngelaki et al., 2009). Thus, memory impairments can affect learning, visuospatial functions and compromise success in school, increasing the risk of school dropouts and juvenile delinquency.

Another neuropsychological function consistently impaired among juvenile delinquents is verbal ability. Verbal skills allow people to express themselves and internally regulate emotions. Verbal ability refers to both receptive and expressive language skills. Receptive verbal ability refers to the ability to exhibit an understanding of a spoken or written word without necessarily describing the word (Lansing et al., 2014). Expressive verbal skills refer to the ability to express thoughts in a grammatically correct way. Expressive ability is associated with the frontal lobe functioning (Broca's area) and receptive ability is associated with the temporal lobe functioning (Wernicke's area).

Damage to these brain structures or connecting subcortical structures may lead to impaired verbal ability in one or both areas of language. Verbal fluency refers to the ability to produce more verbal and visual information within a specified period (Rabinovici et al., 2015). When verbal ability is impaired, people tend to act out in disruptive ways because they are unable to express their wants, needs and frustrations (Thompson, 2016). In addition, verbal deficits affect receptive listening and reading, problem solving, expressive speech, writing and verbal memory (Johnson et al., 2015; Moffitt et al., 2002). Unsurprisingly, impaired verbal ability is linked to conduct disorders, aggression, and juvenile delinquency (Bellair et al., 2016; Tung & Chhabra, 2011; Lansing et al., 2014; Paterson et al, 2013).

In sum, the influence of abnormal brain functioning in the development and maintenance of delinquency cannot be overemphasized. Juvenile delinquents have multiple cognitive, behavioral, and emotional problems that manifests as poor decision-making and rule-breaking behavior (Luna, 2012). The above evidence shows that a combination of several brain functioning factors and psychosocial factors leads to juvenile delinquency and detention. Hence, the need to examine both neuropsychological and psychosocial factors associated with juvenile delinquency.

**Problem statement**

Research has shown that incarceration, while punitive, may lead to a host of mental and physical health problems, reduces academic and employment opportunities for adolescents (Barnert et al., 2017; Van Hout & Mhlanga-Gunda, 2019). In view of this, there is an increased need to plan interventions that targets at-risk populations to intervene early before the crimes are committed. Research from other countries has shown that impaired neuropsychological functions increase the susceptibility of juvenile offending and incarceration (Bellair et al., 2016b; J. B. Borrani, 2011; Fields, 2017; Jackson & Beaver, 2016; Jacob et al., 2019; Zou et al., 2013). Yet, majority of research on delinquency in Ghana have focused on either social/familial and economic factors that are associated with delinquency and these studies argue that rehabilitation efforts should focus solely on alleviating social/familial and economic factors related to delinquency and crime (Boakye, 2012; Boakye, 2013; Bosiakoh & Andoh, 2010; Darkwa & Abass, 2016; Ntim & Manu, 2019; Wrigley-Asante et al., 2016). To the best of my knowledge, one study examined the relationship between poor academic performance and juvenile delinquency (Gyansah et al., 2015). However, this association was examined from a social perspective not a cognitive perspective.

Again, most neuropsychological research in Ghana is plagued with a focus on adult populations (Adjorlolo, 2018; Quansah & Karikari, 2016; Sarfo, 2016; Sarfo & Mate-Kole, 2014; Yorke et al., 2020). Research has shown that children and adolescents differ from adults in cognitive functions and behavioral competencies (Arain et al., 2013; Kramers-Olen, 2015;). Thus, it is necessary to assess the neuropsychological functions of children separate from adults. On the other hand, most of the studies on neuropsychological functions and juvenile incarceration are from the west. Western countries are more of individualistic cultures, which differ from the collectivist culture here in Ghana. It is likely that the neuropsychological profiles of juvenile delinquents in individualistic cultures may differ from juveniles in

collectivist cultures. Hence, needs-based interventions targeting at risk populations should be based on studies that are relevant to our culture.

In addition, understanding the neuropsychological functioning of juvenile delinquents could provide insightful information for rehabilitation purposes to reduce the likelihood of incarceration (detention) and recidivism. Impaired neuropsychological functions including but not limited to executive functions are linked to high rates of recidivism among the youth (Baglivio et al, 2017). Therefore, it is necessary for the rehabilitation protocols to consider the development of delinquency from not only a social or economic perspective but also from a neuropsychological perspective.

**Aim and Objectives of the study**

The main aim of this study is to identify the extent to which neuropsychological functioning domains (executive functions, memory, attention and verbal ability), family factors (single parenting, socio-economic status) and emotional/behavior problems predicts the likelihood of being in juvenile detention by comparing adolescents in detention with a control group, adolescents of the same age group in school. Comparing delinquent adolescents with non-delinquent adolescents gives a better understanding of neuropsychological functioning related with delinquency, in order to plan appropriate interventions in adolescents at risk in the general population.

Specific objectives:

- To identify specific impaired neuropsychological functions that increases the likelihood of juvenile detention or not
- To examine family factors that predict likelihood of children being in juvenile detention or the control group

- To examine the emotional/behavior problems that predicts the likelihood of juvenile detention or the control group.

**Significance of the study**

Currently, neuropsychology is still an emerging field in Ghana and to the best of my knowledge, most neuropsychological studies in Ghana focus on adult clinical populations. As such, there is no data on the neuropsychological profiles of juvenile offenders in the country. Thus, it is expected that findings from this present study will add to the literature on juvenile offending in Accra and provide a better understanding of effects of brain function on delinquency for stakeholders such as the Ghana Police Service, the Ghana Prisons Service and the Judicial System. In addition, findings from this study will inform needs-based interventions on juvenile delinquency, whereby, intervention are tailored to suit the psychological, emotional, educational, social, and mental needs of juvenile offenders in Ghana. Again, findings will serve as a basis for future research in the area of neuropsychology and delinquency in Ghana.

# CHAPTER TWO

# LITERATURE REVIEW

## Introduction

This chapter begins with a focus on the theoretical framework for this present study. Also included in this chapter are the review of related studies on specific domains of neuropsychological functioning and psychosocial correlates of juvenile delinquency. In addition, operational definitions of terms used in this present study, the hypothesis to be tested and the rationale for the study are presented in this chapter.

## Theoretical framework

In this present study, I discuss various theories that suggest that abnormal brain functioning and psychosocial factors lead to delinquency. Each of these theories has their strengths and limitations in explaining the aetiology of delinquency. Among the theories presented are Luria's theory of brain functioning, the General theory of Crime, and the General Strain Theory.

## Luria's theory of brain functioning (Luria, 1974)

This theory of brain functioning also known as the working brain model is one of the most cited theories of brain functioning and it states that the human brain is made up of three basic functional units that are interconnected and whose functioning is integral for all mental activity (Luria, 1974). According to Luria (1974), each of these brain structures is ordered; meaning that it consists of three layers of cortical zones namely, primary, secondary, and tertiary zones. The primary zones receive and send impulses from sensory organs, the secondary zones process sensory impulses, relays programmed impulses to efferent pathways,

and the tertiary zones, which are usually the last to develop, are involved in integrating impulses from many cortical and subcortical structures for complex mental activity.

The first functional unit in Luria's theory is made up of areas of the brainstem such as the thalamus and the reticular activation system below the cerebral cortex. These structures function by regulating cortical tone, waking and mental states. This means that they help to keep the cerebral cortex active and alert (Luria, 1974, Zaytseva et al, 2015). In addition, the reticular activation system functions by helping the nervous system appropriately respond and adapt to environmental changes. Thus, a disruption in this functional unit will result in an inability to appropriately interact with the environment and poor alertness of the cerebral cortex. The second functional unit comprises the occipital, temporal and parietal lobes. These structures function by obtaining, processing, and storing sensory information. Damage to this functional unit can lead to a diminished capacity of the nervous system to orient the first functional unit or a break in the transmission of information to the third functional unit.

The third functional unit is made up of the frontal lobes and it is responsible for regulating, selecting, planning, implementation, and directing behavior and conscious mental activity. In addition, this functional unit is involved in problem solving, executive functions, sustaining attention, insight and awareness According to Luria (1974), this functional unit also has projections to the first and second functional units. In addition, the prefrontal cortex within the frontal lobes has rich connections with other cortical structures, such that the prefrontal cortex regulates impulses from these areas. This means that a person's ability to accomplish a particular task depends on an interaction of all functional units.

Relating this theory to this present study, the frontal lobes are responsible for executive functions and other cognitive functions that enable individuals to carefully think before acting, to adapt to novel or changing situations, resist unwanted impulses, self-regulate and monitor,

to concentrate, to regulate emotions and thought processes (Bechara et al., 2000; Diamond, 2013; Fernandez et al, 2014). Hence, disruptions to areas of the frontal lobes could result in a range of impaired cognitive functions such as executive functions, attention. In addition, disruptions to projections that connect the frontal lobes to parts of the temporal lobes such as the amygdala, hippocampus can result in impaired memory and perhaps verbal ability. Juvenile offenders are susceptible to damage to the frontal lobes because of their increased risk of exposure to violence and violent situations (Farrer & Hedges, 2011). Impaired executive functions among juvenile delinquents manifest as poor emotional and behavioral control, perseveration/ a diminished capacity to learn from punishments, poor decision-making and rule-breaking behavior. This means that structural or functional deficits in the frontal lobes and subcortical structures could result in significant problems in behavior, difficulties in mood regulation and impaired thought processes (Stuss & Levine, 2002), and thus increasing the vulnerability of adolescents to delinquency and other criminal behaviors.

This present study indirectly tests the theory of brain functioning by using cognitive test batteries that are sensitive to abnormal frontal-temporal lobe functions. However, neuropsychological functions due not exist in a vacuum, and so this theory may not be adequate in explaining how family and psychological factors account for juvenile delinquency. Therefore, the General theory of crime and the Strain theory are two theories that help to explain delinquency from a psychosocial perspective.

**General theory of crime (Gottfredson & Hirschi, 1990)**

This theory is an expansion of Hirschi's (1969) social control theory and is based on the claim that poor socialization efforts, especially by parents can lead to low self-control as manifested by antisocial and delinquent behavior. At the core of this theory is self-control, in the sense that individuals who exhibit low self-control are at risk of engaging in delinquent

outcomes. According to Gottfredson and Hirschi (1990), low self-control is a direct consequence of poor supervision or inadequate discipline of children by parents. In addition, they state that parent must monitor their wards, recognize deviant behaviors as they occur and take measures to punish such behaviors. These socialization efforts are of utmost importance for child development as they influence the child's ability to delay gratification and so lead to high levels of self-control (Alshammari, 2017). Hence, individuals with high levels of self-control are more likely to engage in prosocial behaviors and avoid antisocial and analogous behaviors.

This theory places much importance on the family as socialization agents of children. The family is usually the first point of contact people have with the outside world. Therefore, it is not surprising that the family dynamics exerts much influence on the emotional and behavioral development of children. Relating this theory to this present study, juvenile delinquents are individuals who mostly come from single-parent homes, mostly due to divorce/separation, where there may be inadequate supervision and monitoring of children. In addition, a large family size could lead to poor monitoring and supervision, as parents or guardians have to joggle between providing for the family and taking care of a large family size. This present study does not directly test for self-control, which is the core of the general theory of crime theory. However, the theory can still be used to ascertain whether the family factors as measured by single-parent families and large family size can be used as an indication of poor socialization efforts that leads to delinquency and behavior problems.

**General Strain theory (Agnew, 1992; Agnew, 2018)**

The General Strain Theory states that strains increase the likelihood of antisocial outcomes and delinquency. This theory is based on the premise that there is a disconnection between socially desirable goals and the opportunities/resources needed to attain those goals,

creating a "strain". Strains and stressors, which occur as result of negative relationships with significant others, negative life events, can trigger negative emotions, such as aggression, frustration and this makes juveniles males react through crime and delinquency when there are no appropriate ways of coping with the strains or stressors. Thus, when appropriate coping mechanisms failed, an individual will be more likely to adopt inappropriate coping strategies. Agnew (2018) argues that delinquency might be seen as a solution when a depressive individual views delinquency and crime as a means of survival and a way of reducing emotional pressures.

This theory explains how a "lack" can trigger symptoms of internalizing acts such as depression and anxiety and externalizing acts such as aggression and rule-breaking behavior in juveniles. In the sense that, adolescents from poor backgrounds (low socioeconomic status) usually experience some kind of "strain" which increases their susceptibility to delinquent and aggressive acts such as assault, armed robbery and stealing as a way of coping with the strain from a lack of opportunities or resources. Again, this "lack" could trigger symptoms of depression, anxiety and frustration, increasing the susceptibility to engage in delinquency as a way to cope with the negative emotions experienced. Hence, this theory explains from a psychosocial perspective, how negative emotions and behavior problems increases the risk of offending and detention.

Although there is empirical evidence in support of the General Strain Theory, it has been criticized for not taking into account variations in self-control, which directly influences delinquency (Hay, 2003; Walker, 2018). Nevertheless, this theory gives insight into how "strains" usually experienced by juveniles from poor families, increase the risk of emotional and behavior problems.

## Review of related studies

There is extant literature on the neuropsychological functioning and psychosocial correlates of juvenile delinquency. Four domains of neuropsychological functioning: executive functions, attention, memory, and verbal ability are discussed below and these related cognitive functions have been associated with juvenile delinquency. In addition, this present study examines family factors such as family structure, family size and emotional/behavior problems as associative psychosocial factors of delinquency.

## Neurocognitive factors and delinquency

### *Executive functions and Delinquency*

Impaired neurocognitive functions have been found among juvenile delinquents in detention compared to the general population. Research shows that executive functions are one of the most important neuropsychological functions impaired among juvenile delinquents (Adjorlolo & Egbenya, 2016; Burton et al., 2016; Meijiers et al., 2017; Morais et al., 2016; Muscatello et al., 2014; Oglive te al., 2011; Seruca & Silva, 2016; Sukyirun et al., 2016; Wallinius et al., 2019; Yonder et al., 2019; Zou et al., 2013). Impaired executive functions have been shown to differ among offender groups (Burton et al., 2016; Morias et al., 2016). Using behavior rating scales such as the Behavior Rating Inventory of Executive Function (BRIEF) and the Behavior Assessment Scale for Children Self Report (BASC-SR), Burton et al (2016) examined the relationship between executive functions, and delinquency among 196 detained adolescents. Results indicated that juvenile sexual offenders had low IQs and majority evinced severe impairments in executive functioning, particularly in areas of inhibition, working memory, cognitive flexibility and planning than non-sexual offenders.

On the other hand, Morrais et (2016) used cognitive measures of executive functioning among 127 sexual and non-sexual offenders and found no difference on executive functions as

measured using the Sorting test, the trail making test and the verbal fluency test of the Delis-Kaplan Executive Functioning System (DKEFS) and the Wechsler Abbreviated Scale of Intelligence (WASI). However, both groups evinced significant deficits on executive functions, implying that though impaired executive functions may related to delinquency, executive functions were not characteristic of sexual offenders as previously thought. Nevertheless, both studies illustrate that impaired executive functions are linked to not just general delinquency and crime but sexual crimes.

Other studies further examined executive functions and intelligence in the context of negative life experiences such as trauma, domestic violence and victimization (Sukyirun, 2016; Yoder et al., 2016; Zou et al., 2013). Zou et al (2013) studied executive functioning and childhood trauma among juvenile offenders in China. Data was collected from 214 juvenile male offenders and 107 healthy controls using the Spatial Working Memory Test from the Cambridge Automated Neuropsychological Test Battery (CANTAB) and a Chinese version of the Wechsler Adult Intelligence Scale (WAISR). Results showed that detained juvenile delinquents had significantly lower intelligence quotients (IQ) and higher levels of abuse than their normal controls. Moreover, among juvenile offenders, the violent group showed more deficits in executive functioning: set shifting, working memory and planning than non-violent offenders and the control group.

Similarly, Sukyirun (2016) from a biosocial perspective, investigated the association between executive functions and domestic violence. As well as how that relationship influenced self-control and antisocial behaviors among juvenile delinquents of Thailand. The sample used in this study was 294 adolescents between 14-19 years. The Self-Control assessment, Stroop Color Word test, digit span of the WAIS-IV and the 64-Wisconsin Card Sorting test are among the neuropsychological tests used. Results indicate that low inhibited individuals were at an increased vulnerability to antisocial behavior and deviance. In addition, domestic violence

significantly predicted low self-control, and antisocial behavior, implying that children exposed to violence, are more likely to experience low self-control, making them susceptible to delinquency and deviant behavior. Furthermore, Yoder et al (2019) examined the mediatory effect of executive functions in victimization, antisocial traits and delinquency among 70 sexual offenders and 130 non-sexual offenders. The measures used include the Behavior Rating Inventory of Executive Functions-short forms (BRIEF-SR) and a Metacognition index. They found out that a direct relationship exists between sexual violence and working memory. Further, trauma experience inversely related to sexual violence. Implying that childhood trauma is more likely to lead to sexual acting out behavior (sexual violence).

These studies (Sukyirun, 2016; Yoder et al., 2016; Zou et al., 2013) shed more light on our understanding of how the environment or social context of individuals plays a role in juvenile delinquency and also on how negative life experiences relates with cognitive impairments, which increases the susceptibility of "at-risk" juveniles to delinquency and analogous behaviors.

Additionally, executive functions have also been linked to psychiatric disorders and behavior problems among delinquent populations (Muscatello et al., 2014; Yoder et al., 2016). In Italy, Muscatello et al (2014) explored the executive functions in addition to psychiatric disorders of incarcerated adolescent offenders. The samples used were 147 male offenders and a matched control of 150 males. Data was collected by using the Stroop Color-Word Task, the Verbal Fluency Task, Raven's Standard Progressive Matrices, the Paired-Association test, and the Wisconsin Card Sorting Test. Their results indicated that adolescent offenders had high levels of anxiety, performed poorly on the Stroop task, Verbal fluency task, the Wisconsin Card Sorting task and had lower global intellectual functioning than normal controls. This finding implies that impairments in executive functions coupled with indicators of mental dysfunction

may be a causal factor to the persistence of antisocial behaviors evinced by adolescent delinquents.

In addition, impaired executive functions are linked to behavior problems that manifests as antisocial traits (Oglive et al, 2011; Wallinius et al., 2019), suggesting that individuals with poor executive functions may be unable to recognize the impact of their behavior on others, and this manifests as deviance. Specifically, executive functions such as inhibition and uneven intelligence quotient (IQ) profiles have been significantly associated with a high incidence of aggression among violent offenders and younger ages at onset of crime in general (Wallinius et al., 2019). Other studies have found specific deficits in executive functions, in areas of planning and inhibition (Seruca & Silva, 2016; Meijers et al., 2017).

Elucidating neuropsychological antecedents of criminal behavior, Seruca and Silva (2016), considered impaired executive functions among 42 offenders and 28 non-offenders. Data was obtained using the Digit span subtest of the Wechsler Adult Intelligence Scales-3rd edition (WAIS-III), the Trail Making Test, part B, Porteus Mazes and the Stroop Color and Word Test. Results revealed that offenders performed worse on cognitive flexibility measures than non-offenders. In addition, violent offenders performed worse on planning measures. Further analysis suggests that among a subgroup of violent offenders, a significant correlation was found among anger, cognitive flexibility and interference resistance in the offender groups.

Similarly, Meijers et al (2017) investigated whether executive functions differentiated between violent and non-violent offenders. Using 130 male remand prisoners, the CANTAB neuropsychological battery was administered to assess executive functions in planning, cognitive flexibility, working memory and inhibition. It was found out that violent offenders evinced worse performance on measures of inhibition. However, no other difference was found between violent and non-violent groups. Further analysis revealed that deficits in planning were

significantly related to an increased risk of reoffending. Thus, disinhibition and poor planning are specific executive functions that make adolescents in particular more susceptible to delinquency and crime.

Another study in the Netherlands established the association between executive functions, social information processing and antisocial outcomes (Van Nieuwenhuijzen et al., 2017). Ninety-four participants between the ages of 12 and 20 years were used as the sample for this study. Data was obtained using the GoNoGo task, Flanker task, Visual Spatial Sequencing task of the Amsterdam Neuropsychological test battery. Results indicated that impaired inhibition was significantly associated with increased aggression. In addition, participants who performed poorly on attention and inhibition tasks viewed aggressive responses favorably. This suggests that poor inhibition among adolescents increases aggressive tendencies that most likely lead to rule breaking behavior and criminal behaviors.

*Attention, Memory, Verbal ability and Delinquency*

Attention and memory are cognitive processes that rarely take place in isolation and they have been found to be strongly associated with juvenile delinquency. Iselin and DeCoster (2012) studied the unique associations among age, delinquency and cognitive control. They sought to ascertain whether cognitive control processing generalizes to younger adolescent offenders. The sample used includes 43 adolescent offenders, 33 control adolescents and 40 youth male offenders. The Stroop task was used to measure cognitive control in areas of attention, memory, and response inhibition. The Kaufman Brief Intelligence Test was used as a measure of intelligence. Iselin and colleague found that older participants performed better than did the younger participants on task that demanded context-processing skills. In addition, adolescent offenders and adolescent controls had impairments in selective attention when it

comes to filtering irrelevant in that formation as well as memory deficits even when controlling for the effect of age.

Longitudinal studies on sustained attention, verbal ability, and memory have revealed nuanced relationships between these cognitive functions and behavior problems such as rule-breaking behavior and crime (Bellair et al., 2016; Low & Webster, 2016; Petersen et al., 2015). For instance, Low and Webster (2016) examined attention as a mediator between parent-child relationships and behavior problems. A Continuous Performance Test was used to assess sustained attention, the Stroop task was used to assess inhibition, the Tower of Hanoi test was used to measure planning and the Child Behavior Checklist which equivalent to the Youth Self Report scale (YSR) was used to assess behavior problems. Results indicated that there was a relationship between poor attachment and social problems and this relationship was mediated by sustained attention. In addition, the relationship between poor attachment and other forms of behavior problems such as thought problems, rule-breaking behavior and attention problems were mediated by planning.

There is evidence that show that deficits in language and verbal abilities are associated with delinquency, in the sense that adolescents with impaired in reading and writing, expressive and receptive skills are more likely to engage in delinquency. Mannien et al (2013) conducted a study to evaluate whether low verbal ability predicted later violence among adolescents with serious conduct problems. Fifty-three adolescents between the ages of 15 to 18 years staying in a reform school were sampled for the study. The Youth Self Report Scale (YSR) and the Child Behavior Checklist were used to assess psychiatric symptoms associated with delinquency. The Wechsler Memory Scale-Revised, Wechsler Adult Intelligence Scale Revised (WAIS-R) were used as a measure of verbal ability. After comparing the results to a control group from the general population, the findings showed that the adolescents in the reform school performed generally lower on the WAIS-R vocabulary. Further analyses

indicated that low verbal ability and poor attention skills were strong predictors of violent crimes particularly among male adolescents with severe conduct problems.

Lansing et al (2014) studied the cognitive and school functioning of juvenile detainees. They assessed the cognitive functioning of 1,829 recently detained adolescents, ages 10-18 years, in the United States. They examined verbal ability, mathematics skills and general intelligence as academic functioning of juvenile detainees using the Peabody Picture Vocabulary Test-Revised (PPVT-R), the Wide Range Achievement Test-3 (WRAT-3) and the Kaufman Brief Intelligence Test (KBIT) respectively. Their findings indicated that adolescent detainees showed impairments in overall cognitive functioning in areas of receptive vocabulary, oral reading, arithmetic computation skills and general intelligence. Their results showed that male detainees performed poorly on all measures of language and academic achievement. Lansing and colleagues also found that, more than one-third of male detainees showed deficits in both expressive and receptive verbal skills. However, greater deficits were on receptive verbal domains than in the expressive domains. In addition, they performed poorly on measures on arithmetic skills. This study suggests an undeniable link between verbal ability and academic performance.

Another study focused on the comparison of general and verbal intelligence and academic achievement among criminal juveniles and non-criminal juveniles (Moshkani et al., 2017). Moshkani and colleagues collected data from 71 male delinquents and 71 controls in a rehabilitation center and public school respectively. The Wechsler Intelligence Scale for children (WISC) was used as a measure of general intelligence and verbal intelligence. They also used a demographic questionnaire to collect data on academic achievement, specifically the average of the last academic year in addition to subscales on the WISC. They found that controls performed better on measures of general intelligence than criminal juveniles. In addition, delinquents had lower years of education, lower verbal intelligence and poor academic

performance compared to controls. Thus, low verbal ability, poor academic performance and low educational years more likely leads to delinquency and subsequent arrest.

In Longitudinal studies investigating verbal ability and the development of behavior problems and crime, Petersen et al (2015) found that language ability was negatively associated with externalizing problems even when controlling for age, SES and academic performance. This means that poor language ability in early childhood increased the likelihood of behavior problems and delinquent outcomes later in life. Likewise, Bellair et al (2016a) used Moffitt's developmental taxonomy to ascertain whether verbal ability differentiated between offending groups, specifically adolescent-limited, life-course persistent, late bloomers and non-offenders. Results on key measures of development revealed that low verbal ability significantly increased the odds of becoming a life-course persistent offender compared to the adolescent-limited group. In addition, low verbal ability more than doubled the odds of life-persistent offending. Familial factors such as low family financial status and high peer substance use also increased the possibility of life-course persistent offending relative to adolescent-limited offending. Thus, poor verbal ability is one of the strong indicators for juvenile delinquency and criminal behaviors in adulthood.

Snow and Powell (2011) assessed expressive language competencies among young offenders in incarceration. They also focused on offending severity, mental health and other risk factors that have not been studied previously. A sample of 100 young offenders with an average age of 19.03 (age range 17-20years) was used in the study. The Test of Language Competence-Expanded edition, the Clinical Evaluation of Language Fundamentals, the Depression/Anxiety Scale (DASS) and the Kaufman Brief Intelligence Test were some of the measures used in the study. Results indicated that those who committed violent crimes had more language deficits. Those with language deficits also had poor scores on the matric subsets

of the Kaufman Intelligence Test. Again, there were no differences between offenders with language deficits and offenders without language deficits on the DASS.

*Academic performance and delinquency*

Research has shown that a link exists between academic performance and behavior problems. Tan et al (2018) investigated the link between schooling and delinquency between two groups of incarcerated youth. The sample included 333 male sexual offenders and 171 non-sexual offenders with a mean age of 16.7 years and 16.5 years respectively. Findings indicated that juvenile male sexual offenders reported higher levels of delinquency than the non-sexual offenders did. Furthermore, sexual offenders had significantly worse academic performance than the non-sexual group. Additionally, the sexual offenders also had greater communicative difficulties compared to the non-sexual offenders. Other studies have found similar results indicating that lower levels of intelligence quotients (IQ) influences academic achievement, which in turn, proliferates the risk of juvenile delinquency and incarceration (Hoffmann et al., 2013; Tan et al., 2018). Hence, in this present study, general fluid intelligence, academic performance as well as age were examined as control variables.

**Family Factors and delinquency**

*Family Structure, Family size, Socioeconomic status and Delinquency*

Research on the causes or risk factors of delinquency have shown that familial factors are robust predictors of behavior, emotional problems, and juvenile offending. In Sub-Saharan Africa, research have found that parenting and parenting styles, family structure (Boakye, 2012; Boakye, 2013; Balogun & Chukumezie, 2010), cultural/ethnic beliefs, mass media (Osagie-Obazee & Eduwen, 2016), unstable family backgrounds with inadequate supervision (Duruji & Onyekachi, 2015) were significantly linked to juvenile delinquency and incarceration.

Boakye (2013) investigated the correlates and predictors of official and self-reported juvenile delinquency among 264 male juvenile offenders aged 12-18 years using a set of questionnaires. The results indicated that among the various offenses in Ghana, drug offense (40%), serious property crimes (38.3%), and violent offense (35.7%) were among the common crimes committed by the youth. Logistic regression analysis showed that among individual factors, academic difficulties and low religiosity more than doubled the odds of official delinquency and self-reported delinquency. In addition, family factors such as harsh discipline, single-parent families, parent arrest/deviance significantly predicted the likelihood of official and self-reported juvenile delinquency. However, family size (although increased the risk of juvenile delinquency) did not significantly increase the odds of offending.

In a qualitative study, Boakye (2012) explored the lived experiences of juvenile offenders in Ghana. He recruited 6 young offenders who were incarcerated at the Borstal home (now the Senior Correctional Centre). A semi-structured interview guide was used to collect data from respondents. Findings revealed that the young offenders reported having delinquent peer associations and substance-use prior to arrest. Among the family characteristics, single parent homes with little or no supervision and discipline lead to delinquency. Poverty in the family also resulted in school dropouts increasing the chances of stealing and robbery as a means of survival. Suggesting that for most children caught up in a life of crime, delinquency was a means to an end- being able to escape unfortunate family conditions. Thus, juvenile delinquency can be viewed as a complex phenomenon that requires a holistic solution.

Longitudinal studies examining long-term influence of social and environmental factors deepen our understanding of delinquent behavior. Parental and family factors such as single parenting, poor parental supervision (Boccio & Beaver, 2019) and poor parental supervision and low socioeconomic status (Rekker et al., 2017) have been shown to be strong predictors of delinquency and crime in children. Boccio and Beaver (2019) investigated family factors as

antecedents of delinquency and found that family structure in adolescence was associated with later delinquency. In that, children who grew up with both parents were less likely to be involved in delinquent acts during adolescence and adulthood and vice versa. In addition, experiencing parental divorce during adolescence was statistically correlated with changes in whether or not children get involved in delinquent acts and crime. This implies that stressful events in the family make an individual susceptible to engaging in deviant and criminal behaviors.

A similar longitudinal study on family factors associated with delinquency, focused on an interplay of parental supervision and socioeconomic status (Rekker et al., 2017). Regression analyses revealed that between adolescents, there was no significant association among parental monitoring and control and delinquency independent of socioeconomic status. However, within adolescents, parental control was positively associated with delinquency but this relationship was dependent on low socioeconomic status. This finding implies that parent from low socioeconomic backgrounds may be using less effective monitoring which rather increases delinquency.

Similarly, Nisar et al (2015) explored the influence of family, peer, and economic factors on the development of delinquency among adolescents. Results indicated that majority of adolescents were from nuclear families with single parents. Further analyses revealed that adolescents are at an increased risk of delinquent outcomes when there little or no structure in the family. In addition, it found that most of these adolescents were from poor economic backgrounds and most of them admitted spending most of their time associating with delinquent peers. These results support the assertion that low economic and poor economic background is one of the basic reasons why adolescents engage in delinquency, which is further heightened as they begin to associate with delinquent peers.

Another qualitative study in India explored the major psychosocial factors that increase the likelihood of juvenile delinquency and the measures taken by the government to rehabilitate delinquents (Achakanalli & Kumbhar, 2018). Using secondary data, results showed that 50% of juvenile delinquents come from single-parent families, suggesting that family background was crucial in the development of delinquency. Again, poor academic performance, bad neighborhoods, deviant peer relations, in addition to mental disorders, antisocial personality and low self-esteem were found to be associated with delinquent acts such as rape, theft, murder and robbery amongst others in the state of Maharashtra, India.

On the contrary, Coleman (2014) examined juvenile delinquency from a family-oriented approach. Using secondary data, Coleman (2014) reviewed several media reports and academic research and found that, while dysfunction in the family such as a bad divorce negatively affects parent-child relationships, single-parent families are not a direct predictor of delinquency. Thus, single-parent homes become significant in the development of antisocial and deviant behavior in the presence of other factors such as poor attachment, lack of discipline.

In a very recent study, Kroese et al (2020) investigated how growing up in single-parent families increases future crime involvement. This study differed from other studies in the sense that, different aspects of single parent i.e., single parent by death, divorce etc. was included in analysis. Using a systematic review of 48 studies on single-parenting and delinquency, results showed majority of studies reported that growing up in single-parent families significantly increases the risk of juvenile offending. Further analysis indicates that, adolescents from single parent families by divorce evinced higher levels of delinquency than did adolescents from single-parent families by death.

Singh and Kiran (2014) examined the relationship between family structure and juvenile delinquency. A review of previous studies on the subject matter suggested that among

the most common correlates of juvenile delinquency, family factors (single-parent families) was the strongest predictor of delinquency. Singh and Kiran (2014) found that single-parenting affects the mental, emotional and psychological functioning of children, especially when working parent do not have sufficient time for their children. This increases the vulnerability of children to deviant and criminal behaviors. Other correlates of juvenile delinquency included family low socioeconomic status, psychological issues such as depression, aggression, frustration, as well as negative peer influence, and substance use.

Similarly, Schroeder et al (2010) conducted a study on family transitions and juvenile offending. However, the study differed from other studies on single-parenting and delinquency in the sense that, Schroeder et al (2010) assessed the effect of changes in family structure on delinquency through mediating processes of family times and parent-child relationships. A longitudinal research design, a series of survey questionnaires were used to obtain data from over 1,073 respondents in 4 waves. Control variables included age, race, as these factors have been found to contribute to juvenile offending. Multiple regression produced mixed findings suggesting that a transition from two-parent families to single-parent families was not significantly associated with family time or changes in family time, parent attachment, and delinquency. However, further analysis indicated that a transition from single-parent families to a two-parent (stepparent) family significantly increased criminal behavior. Again, single parent homes through divorce or separation did not correlate with increased offending. Lastly, while single-parent homes can increase the risk of children becoming delinquent, an increase in family time and parental attachment served as a protective factor by decreasing the impact of family transitions on children.

Shong et al (2019) conducted a qualitative study on socioeconomic status and behavior development and delinquency. Six young offenders between the ages of 13 and 17 years were recruited for the study. Results showed that children from low socioeconomic backgrounds

experienced negative emotions, which in turn triggered delinquent behavior as a coping mechanism. Again, children from low socioeconomic status experience school failure and consequently had to dropout from school to reduce family financial burden. Further, frustration with family low socioeconomic status and school failure increased delinquent peer associations.

Studies in Nigeria on family factors and delinquency have showed mixed results. One study by Balogun and Chukumezie (2010) investigated the influence of family environment, parenting styles and self-esteem on delinquent outcomes. They collected data from 210 participants (mean age 13.7years) in remand homes in Lagos. Results indicated that family relationship and parenting style predicted juvenile delinquency. In addition, high self-esteem levels were significantly associated with less delinquency. Further, two dimensions of parenting predicted juvenile delinquency: responsiveness and demandingness but not autonomy granting. On the other hand, Osagie-Obazee and Eduwen (2016) conducted a study on the influence of family factors on delinquent outcomes. They collected data from 200 adolescents in secondary schools in Edo. Major findings showed that parenting styles, family structure, and socioeconomic status did not significantly account for delinquent outcomes. However, mass media, cultural/ethnic beliefs were found to be responsible for delinquent outcomes. Likewise, Duruji and Onyekachi (2015) assessed the relationship between family instability and juvenile delinquency in Owerri, against a backdrop of increasing family instability. Five hundred and ten participants in secondary school were recruited for the study. A questionnaire and interview guide were used in data collection. Results showed that children from unstable homes with inadequate supervision reported higher levels of predicted juvenile delinquency than those from stable families did.

**Emotional and Behavior problems and delinquency**

Emotional and behavior problems are well-established factors associated with juvenile delinquency and incarceration. Research has found that emotional problems such as anxiety and depression (Anderson et al., 2012; Jolliffe, et al, 2019), low self-esteem and suicide ideation (Chung et al., 2020) to be significantly associated with delinquent outcomes. Others have found that depression and aggression (Mestre et al., 2017), internalizing and externalizing behaviors (Lee-Oh et al., 2018), and mental health problems (Vahl et al., 2016) are important antecedents to juvenile delinquency and incarceration.

For instance, Jolliffe et al (2019) investigated the relationship between anxiety and depression levels and delinquent acts such as theft and violence. Five hundred and three boys ages 11 to 16 years were recruited for this study. Using a series of questionnaires, result indicated that children with high levels of depression and anxiety also reported high levels of delinquent behaviors, particularly theft and violence. Furthermore, Anderson et al (2012) examined the long-term consequences of adolescent depression as a predictor of criminal behavior. Anderson et al (2012) used data from a national longitudinal study and found that adolescent depression increased the probability of property crime (4.7%), violent crime (2.0%), drug-related crimes (1.3%), and nondrug-related crimes (4.5%). However, when controlling for school performance, socioeconomic status, parenting style, and home environment, the influence of depression diminished but remained significant for only property offenses and nondrug-related crimes. In addition, even after controlling for school, family and parenting factors, the relationship between adolescent depression and the propensity to commit property and non-drug related crimes in adulthood remained significant. Thus, emotional problems such as depression and anxiety make children more susceptible to a life of crime particularly property offences such as theft, burglary, shoplifting amongst others.

Recently, Chung et al (2020) examined the relationship between ADHD, suicide ideation, depression, anxiety, self-esteem, substance use and juvenile delinquency in Korea. Data was collected from 149 juvenile delinquents and 102 controls using a series of questionnaires. Findings revealed that juvenile delinquents had significantly more attention problems, suicide ideation, depression and anxiety and lower lever levels of self-esteem than controls did even when age and gender was controlled for. In addition, logistic regression showed that juveniles with attention and hyperactivity disorder were significantly up to 1.05 times more likely to commit crimes and those with higher levels of self-esteem were 0.93 times less likely to offend.

Other studies suggest the environment can significantly affect mental health outcomes, triggering internalizing and externalizing behaviors among adolescents. Lee-Oh et al (2018) in a systematic review of child health outcomes associated with childhood adversity found that childhood adverse conditions such as trauma, abuse amongst others affects the development of a healthy brain and several other physiological functions that manifests as somatic complaints, asthma, recurrent infections requiring hospitalization, and sleep disturbances among children. Among young offenders, Mestre et al (2017) examined the influence of depression and aggressive behavior among juvenile offenders and non-offenders. They collected data from 220 detained juvenile offenders and 220 non-offenders in public schools between the ages of 15 and 18 years. Results indicated that anger predicted depression and aggressive behavior and delinquency among juveniles through emotional regulation. Thus, when children are unable to effectively regulate their emotions, it triggers maladaptive coping such as depressive and aggressive behaviors that more likely leads to delinquency and subsequent arrest.

Vahl et al (2016) investigated the unique relationship between emotional abuse and mental health problems among detained juvenile delinquents. They used 341 detained adolescents as the sample in their study. Data was collected using the Youth Self Report Scale

and the Childhood Trauma Questionnaire. Multiple linear regression analysis revealed that emotional abuse was significantly related to internalizing and externalizing mental health outcomes even after the effect of other types of maltreatment were controlled. This study supports the claim that mental health and abuse predispose adolescents to delinquency and crime.

**Rationale of the study**

From the above, it is evident that much attention has been directed towards examining impaired neuropsychological functions associated with delinquency. However, there is a focus on single cognitive domains of juvenile delinquents in western countries and other parts of the world (Bellair, et al., 2016; Lansing et al., 2014; Zou et al., 2013). This present study builds on existing research by assessing multiple neuropsychological domains, which reveals nuanced group differences on specific domains of neuropsychological functions among detained juvenile delinquents and matched controls.

In the studies reviewed, most studies used few measures in their assessment. According to Rabinovici et al (2015) using converging evidence from more than one test that measure separate but related functions in the same cognitive domain, gives a stronger evidence of brain functions compared to using single tests. Other studies that have used multiple tests that assess similar but separate functions within the same cognitive domain support the claim by Rabinovici (Lansing et al., 2014; Low & Webster, 2016; Mannien et al., 2013). Again, a number of studies reviewed used behavioral (self-reported) measures to assess cognitive domains including but not limited to executive functions (Burton et al., 2016; Yonder et al., 2019). Using only self-reported measures of neuropsychological functions may be less objective compared to using performance-based tests or both. This present study uses a battery

of neuropsychological tests to assess cognitive domains of executive functions, attention, memory, verbal ability, and academic performance.

Moreover, majority of delinquent studies in Ghana focus on social and economic correlates of juvenile delinquency (Boakye, 2012; Boakye, 2013; Bosiakoh & Andoh, 2010; Darkwa & Abass, 2016). This present study fills in the gaps in the literature by assessing neuropsychological factors in addition to well-established psychosocial predictors of juvenile delinquency among juveniles in detention and a control group. Lastly, we assert that having an understanding of which neuropsychological functioning specifically correlates with delinquency will provide insightful information for the Ghana Prison Service on needs-based intervention that targets at-risk populations to reduce the likelihood of incarceration and recidivism in Ghana. Thus, neuropsychological and mental health factors could be included in the already existing reformation programs for juvenile offenders at the Senior Correctional Centre.

**Hypotheses**

The main research question in this study is to what extent does neuropsychological functions (executive function, memory, attention and verbal ability domains), family factors (such as socioeconomic status, family structure and family size) and emotional/behavior problems predict the likelihood of juvenile detention? Age, academic performance and general intelligence will be controlled in each hypothesis.

Hypotheses include:

1. Poor neuropsychological functioning (executive functions, memory, attention, and verbal ability) would increase the likelihood of being in juvenile detention.

2. Family factors (socioeconomic status, family structure, family size) would significantly increase the likelihood of juvenile detention.

3. Emotional and behavior problems would predict the likelihood of juvenile detention

**Operational Definitions**

**Executive functions**- Cognitive Flexibility (set-shifting) and Inhibition

**Attention**- Sustained auditory attention and visual attention

**Memory**- verbal memory and visual/spatial memory

**Verbal ability**- verbal Fluency and word knowledge.

**Family structure-** Single parent families, Both parent families and others

**Single-parent families**-living with either one of parents (i.e. biological mother, biological father) whether by death or separation/divorce

**Both Parent families**- living with both mother and father (i.e. biological parents or step parents).

**Socioeconomic status**- Highest level of parental education, Parental employment, Ownership of TV set and Car.

**Emotional/behavior problems**- internalizing (depression, anxiety, somatic complaints) and externalizing behaviors (rule breaking behavior and aggression)

# CHAPTER THREE

# METHODOLOGY

## Introduction

This chapter entails all the methodological issues entailed in this study of the neuropsychological functioning and psychosocial correlates of juvenile offending: comparing detained delinquents and a matched control. Much of the focus of this chapter is on the research design used for the current study, detailed description of the target population, sample (inclusion and exclusion criteria) and sample size. Also discussed in this chapter are the measures used for data collection, the procedures involved during data collection, as well as ethical considerations and issues that arose during data collection.

## Research design

This research is a quantitative study based on the quasi-experimental design. According to Abraham and MacDonald (2011), the quasi-experimental design is a unique research method that is similar to the experimental design but different in the sense that there are no random selections, in some studies no control group and in some studies no active manipulation of the independent variables. In this present study, there was no active manipulation of independent variables, and inferences were made on the population of interest without randomly assigning participants to either the children in detention group or the matched control group. Further, quasi-experimental designs offer the advantage of testing out comparisons between similar groups of people and in this present study, both control and detained delinquent groups were matched on age, gender and socio-economic status.

**Target population and Sample**

The targeted population of the study was juvenile delinquent males who are between the ages of 14 and 18, who reside in detention centers in Accra and adolescent males of the same age groups who attend public schools within the vicinity in the Greater-Accra Region of Ghana. According to the Ghana Statistical Service (2013) report, juveniles between the ages of 10 and 19 make up approximately 22.4% of the total population in Ghana, with approximately 19.3% in Greater-Accra region.

The Senior Correctional Centre was purposively chosen as the site for data collection and the Kanda Cluster of schools was conveniently chosen as the site for this present study. These choices were based on the fact that, the Senior Correctional Centre is currently the only operational facility where juvenile male delinquents are detained. The Senior Correctional Centre is a detention center under the Ghana Prison Service for juvenile and young adult offenders in Ghana, under the Juvenile Justice Act 2003. Thus, juvenile offenders from all 16 regions of Ghana are detained at the Senior Correctional Centre. The Kanda cluster of schools is a government institution under the Ayawaso-East district. There are four different schools on site: the Kanda Estate 1, Kanda Estate 2, Ring Road and the AMA basic 1 school. The school is located in the environs of the Senior Correctional Centre, which is approximately 4.2 kilometers away from the Senior Correctional Centre. Hence, for proximity and convenience, the ideal site for data collection.

**Sampling size and Sampling technique**

The sample tested in this study was 115 male participants based on a limited number of male delinquents at the Senior Correctional Centre and a matched control at the Kanda Cluster of Schools. Approximately 245 male delinquents resided at the Senior Correctional Centre at the time of this study and these participants need to be selected based on different age cohorts

(14-18 years). In light of this, participants were recruited based on a crude sample size estimation by Roscoe (1975) that suggests that a sample size of at least 10 different participants per variable. However, during data collection at the Senior Correctional Centre more of the detainees were above the age group of interest to this study. Therefore, only 84 male participants (ages 14 to 18 years) who were readily available and willing participated in this study. In addition, due to the Covid-19 protocols and shutdown of public schools at the time of data collection, participants became a hard-to-reach population. Hence, only 31 participants from the Kanda Estate 1 and the Ring Road Schools participated in this study. The purposive sampling technique was used to select participants for this study because the adolescent delinquents and controls were matched on certain variables such as age (14-18 years), gender, and socioeconomic-status. This reduces testing bias, as juveniles in detention are compared with a control group of similar characteristics such as age, gender and socio-economic status on various cognitive and psychological tests.

**Inclusion criteria**

Delinquents were included in this present study if they a) were between the ages of 14 to 18 b) were residing at the Senior Correctional Centre for four months during data collections c) had a basic proficiency in English and could communicate in Twi or Ga, two common languages in Ghana. This is because some of the tests and questionnaires used were translated into the two most common local dialects, Twi and Ga. For controls, participants were included if they a) were between the ages of 14- and 18-years b) had a basic proficiency in English, Twi or Ga. Participants were excluded from this study if they had been diagnosed with a psychiatric condition or had any obvious intellectual disability.

**Demographic Characteristics**

Table 1 shows distribution of participants across all demographic variables examined in the study. Concerning educational level, it can be observed that close to one-half of participants in the control (48.4%) were in JHS 2 and those in the detention group (46.4%) were in primary. Again, slightly more than half of the children in the detention group (54.8%) had a history of substance use. Moreover, majority of children in the detention group (60.7%) had been sentenced within a year. It was further noted that among the children in detention, majority (61.9%) had committed non-violent crimes. More so, participants in both control and detention groups had below average general fluid intelligence. Finally, majority of the participants in the detention group (63.1%) were above 16 years compared to the control group (41.9%).

**Table 1**

***Summary of demographic characteristics of children in detention and matched control***

| Variable | Category | Control Group | | Detention Group | |
|---|---|---|---|---|---|
| | | Frequency | % | Frequency | % |
| Educational Level | At most Primary | 3 | 9.7 | 40 | 47.6 |
| | JHS 1 | 9 | 29 | 11 | 13.1 |
| | JHS 2 | 15 | 48.4 | 24 | 28.6 |
| | JHS 3 | 4 | 12.9 | 9 | 10.7 |
| Family Structure | Single Parent | 11 | 35.5 | 46 | 54.8 |
| | Both Parents | 12 | 38.7 | 19 | 22.6 |
| | Other | 8 | 25.8 | 19 | 22.6 |
| History of Substance Use | Yes | 0 | | 44 | 52.4 |
| | No | 31 | | 40 | 47.6 |
| History of discipline | Yes | 15 | 51.6 | 36 | 42.9 |
| | No | 15 | 48.4 | 48 | 57.1 |
| Duration in detention | 1-12 months | - | - | 51 | 60.7 |

| | | | | | |
|---|---|---|---|---|---|
| | 13-24 months | - | - | 24 | 28.6 |
| | 25-36 months | - | - | 3 | 3.6 |
| Type of Crime | Violent | - | - | 32 | 38.1 |
| | Non-Violent | - | - | 52 | 61.9 |
| General Fluid | Below 50$^{th}$ percentile | 24 | 77.4 | 78 | 92.9 |
| | 50$^{th}$ -60$^{th}$ percentile | 4 | 12.9 | 3 | 3.6 |
| | Above 60$^{th}$ percentile | 3 | 9.7 | 3 | 3.6 |
| Age Group | 14 years | 9 | 29.0 | 5 | 6.0 |
| | 15 years | 8 | 25.8 | 14 | 16.7 |
| | 16 years | 9 | 29.0 | 20 | 23.8 |
| | 17 years | 3 | 9.7 | 22 | 26.2 |
| | 18 years | 2 | 6.5 | 23 | 27.4 |

**Data collection measures**

The data collection measures in this study include a battery of neuropsychological test, and questionnaires. A questionnaire was used to obtain data on demographic variables such as age, level of education, duration of prison sentence, type of crime and substance-use and important family factors such as family structure, socioeconomic status and family size. The battery of neuropsychological tests was used to assess specific cognitive domains such as executive functions, attention, memory, verbal ability, and academic achievement. Another questionnaire was used to assess emotional/behavior problems.

**Neuropsychological Tests**

*Executive Function*

a. Trail Making Test A and B (Partington & Leiter, 1949): The Trail Making Test (TMT) is a timed test of abstract reasoning, hand-eye coordination, and executive function two parts, A and B. In Part A, the participant is required to draw lines to connect consecutively encircled numbers on a worksheet, without lifting the pencil off the

worksheet. Timing begins as soon as the instruction to start is given and stopped once the trail is completed or when maximum time is reached (150seconds). In Part B, the participant alternates between encircled numbers and letters in order as quickly and accurately as possible without lifting the pencil from the paper. The participant is timed as soon as the instruction to start is given and stopped once the trail is completed or when maximum time is reached (300sec). If the participant makes an error during the trial making (A and B), they are to quickly correct the error and this affects the length of time it takes to complete the trail. Hence, the TMT is scored by the length of time it takes to complete the trail with longer times of completion usually indicative of deficits in executive functioning. It usually takes approximately 5 to 10 minutes to administer the test. The TMT has been standardized on adolescents and adults. In general, reliability coefficients of the TMT fall within the 90s (Spreen & Strauss, 1998). In Ghana, the TMT has been shown to have excellent diagnostic accuracy with area under the curve (AUC) values ranging from .674 to .912 (Adjorlolo, 2016).

b. Modified Card Sorting Test (MCST; Nelson, 1976): The MCST measures the ability to form abstract concepts and to shift between response sets (cognitive flexibility) and inhibition. Four stimulus cards, each depicting a single red triangle, two green stars, three yellow crosses and four blue circles respectively. Participants sequentially select from a pre-sorted deck of 48 cards that vary in the combinations of colour, shape and number. They are asked to match each card to one of the stimulus cards. The criterion for matching is not stated, but the participant is given feedback after every response made. After six consecutive correct matches, the criterion changes, making a maximum of eight categories to be achieved. The MCST, is scored on various items but only the number of categories achieved and the number of perseverative errors is used in this study. Other studies report that the number of categories and perseverative errors are

good indicators of cognitive flexibility and inhibition (Muscatello et al., 2014; Sukyirun et al., 2016). The MCST takes approximately 20 minutes to administer. The MCST is reported to have excellent reliability estimates of .90 (Kopp, Lange & Steinke, 2019). Nyongesa et al (2019) reports that the MCST has excellent convergent validity with other tests of executive functions such as the Behavior Rating Inventory for Executive Functions (BREIF).

*Attention*

a. Digit span (Forward and Backward; Wechsler, 1949, 3rd and 4th edition): The digit span falls under the Working Memory Index of the Wechsler Intelligence Scales. The digit span subtest measures short-term auditory memory and attention. This test is easy to administer and it takes approximately 5-10 minutes to complete. The digit span contains two parts: forward and backwards. In the digit span forward, an examiner orally presents a series of numbers to a participant. The participant is required to recall and repeat the numbers exactly as presented. In the digit span backwards, the participant is required to recall and repeat a series of numbers in the reverse order presented, which is more challenging. There are eight items in both forward and backward digit span, with two trials for each item. A score of one is given for correct responses in each trial on an item, making a total of two for every item. A score of zero is given for incorrect responses. The total score for digit span forward and backward is summed to obtain a total subset score. The digit span test is suitable for use with adolescents and adults.

Most research report excellent Cronbach's alpha of .92 and test-retest coefficients of .89 (Flanagan & Kaufman, 2009). Others report good internal consistency of 0.85 (McAuley et al., 2017; Nyongesa et al., 2019). In this present study, Cronbach's alpha (α) = .637 was within acceptable range. The scaled scores will be used in analysis in this study.

b. Pair Cancellation Test (Woodcock-Johnson, 2002; 3rd edition): This test was designed as part of the extended battery of the Woodcock-Johnson test of Cognitive Abilities and it measures the ability to sustain attention. The pair cancellation test was standardized on individuals aged 5-95 years. The participant is required to visually scan for the two items (a ball and a dog) presented and circle these items as they appear in that particular order from several rows of other non-relevant items within 3 minutes. The pair cancellation test is scored by recording completion times and summing up the number of correct responses (i.e. ball and dog) after the test is completed. Lower score indicates impaired ability to sustain attention. Standard scores will be used in data analysis in this study.

*Memory*

a. Californian Verbal Learning Test- Short Form (DeLis, Kaplan & Ober, 2004): This test measures various aspects of verbal learning and memory. It involves recognizing and recalling a list of words in immediate, short and delayed trials. Only the short-delayed and long-delayed recall trials were used as a measure of verbal memory. The Short Form of the Californian verbal learning test was modified to include a list of 9 words to be recalled over four trials. This was because certain words on the original test such as cherries, wrench, peaches and drill may have been unfamiliar with the sample of this study. Thus, these words were replaced with guava, spanner, apple, scissors and chisel. Reliability estimates of the Californian Verbal Learning Short-Forms are reported to range between 0.68 to 0.79 (Kreutzer, DeLuca & Caplan, 2011). Lower standards scores, indicate performance is below the mean for the age group.

b. Rey-Osterrieth Complex Figure Drawing [Rey (1941) & Osterrieth (1944)]: This test provides information on cognitive functions such as memory, attention, working

memory, planning and visual spatial abilities and is sensitive to brain damage to the frontal-parietal regions of the brain. The test consists of three conditions: copy, immediate recall and delayed recall. The delayed recall condition was administered as a measure of memory in this current study. In the delayed recall, the participant is required to draw the stimulus from memory after a 20-minute delay. In scoring the Rey Complex figure drawing, scores are related to location, accuracy, and organization. This test has been standardized on children, adolescents, and adults and therefore appropriate for use with juvenile delinquents. The maximum score on this test is 36, with lower scores indicative of deficits.

*Verbal Ability*

a. Kilifi Naming Test (KNT; Kitsao-Wekulo et al., 2013): This is a test of expressive vocabulary, in which the child labels each of a selection of pictures. Children are required to name stimuli presented in black and white drawings in a language they are most proficient in to remove the bias of education. There are 61 items in the KNT. Responses are scored with or without cues. For instance, a score of 2 points is given for correct responses without cues, a score of 1 for correct responses with cues and 0 for incorrect responses. Higher scores indicate excellent expressive (verbal) fluency and lower scores indicate poor expressive skills. In this present study, the KNT was found to be very reliable, Cronbach's alpha (α) = .89. Raw scores are used in this study.

*Academic Performance*

a. Literacy and Numeracy Tests: This test measures academic performance based on the academic curriculum for basic schools in Ghana. It consists of a literacy section that has six levels that assess letter recognition, word reading, sentence recognition, sentence completion, comprehension and expression and writing skills of an individual. The numeracy section consists of six levels that assess number recognition, bigger-

small recognition, addition and subtraction, multiplication and division and math problems. In both sections, the participant is required to pass each level before progressing to the next. A score of 1 is given for correct responses and 0 for incorrect response, making a total score of 12 for both literacy and numeracy sections. Lower scores suggest poor academic performance. In this present study, this scale was reliable; Cronbach's alpha (α) was within excellent ranges of .80.

*Intelligence*

a. Raven's Standard Progressive Matrices (Raven & Raven, 1939): The RPM is a 60-item test designed to measure abstract reasoning and general fluid intelligence. The RPM consists of five sets (A-E) of 12 items in each set, making 60 items. Items include a pattern or figure with a missing part. The participant is required to identify the missing part from a number of choices. The test is designed to become increasingly difficult as the participant progresses. The patterns are presented in a 4*4, 3*3 or 2*2 matrix. The total correct responses are summed for each set (A-E) creating a total scale score for the RPM. This test is appropriate for individuals between the ages of 5 to 90 years. It takes approximately 15-30 minutes to administer and it was designed to be independent of writing and reading skills compared to other tests of intelligence. The RPM has been shown to be reliable, with Cronbach's alpha ranging from .88 to .90 representing high internal consistency (Abdel-Khalek, 2006). In this present study, Cronbach's alpha (α) was within acceptable range of .79. Raw scores were transformed into z scores for data analysis.

**Emotional and Behavior Measures**

The Youth Self Report Scale (Achenbach, 1991): This is a multidimensional scale designed to measure adolescent emotional and behavior problems. It has 8 subscale syndromes

that measure anxious/depressed (score range of 0-26), withdrawn/depressed (score range of 016), rule-breaking behavior (score range of 0-30), somatic complaints (score range of 0-20), thought problems (0-24), attention problems (0-18), aggressive behaviors (score range 0-36) and relational problems (score range 0-22). These subscale syndromes according to Achenbach (1991, 2003) are based on the Diagnostic and Statistical Manual for depression, anxiety, somatic problems, attention deficits, oppositional defiant problems and conduct problems. This is a 112-item self-report measure for children and adolescents (ages 11-18). It assesses emotional and behavior competency and problems in the past six months. Responses are scored on a three-point scale (0-not true, 1-somewhat true, 2-very true or often true). A total scale score for each dimension is obtained by summing the responses for items in each subdimension. Higher scores on the scale are usually indicative of impaired emotional and behavior functioning. Cronbach's alpha for the YSR is reported at .86. In this present study, Cronbach's alpha (α) was within excellent range of .87.

**Procedure for data collection**

The researcher and a research assistant were trained to administer a battery of neuropsychological tests under supervision for 4 hours each day for two weeks in the last week of September 2019 and the first week of October 2019. Subsequent training without supervision was done for an additional week. A pilot study was conducted in November 2019 at the La-Bawaleshie Basic 1 School in East Legon, Accra. Permission was sought from the Accra Metro Assembly, the Ghana Education Service, the Ayawaso West Wagon Municipal Assembly, the Circuit Supervisor and the La-Bawaleshie Basic 1 School. Twenty male participants who were between the ages of 12 and 18 were randomly selected for the study. Data collection was done during Physical Education/Music & Dance periods, which was approximately 45 minutes. Participants were assessed in the ICT lab two times a week for two weeks. Participants were refreshed with bottle of water and snacks.

For the main data collection, permission was sought from the Ghana Prison Service Headquarters, the Ayawaso East Wagon Municipal Assembly, the Senior Correctional Centre and the Kanda Cluster of Schools. Data collection started in December 2019, during school hours, at the Kanda Cluster of schools. Participants were selected from two schools at the Kanda Cluster or Schools, starting with the Ring Road school and then the Kanda Estate 1. Participants were selected from the class register based on their date of births. Therefore, participants between 14 and 18 years were selected from form 1 to form 3. Participants below 18 years were given assent forms to fill and consent forms to give to their parents/guardians.

A quiet place was provided by the school administration for assessment. The researcher assessed the participants on the neuropsychological tests, while the research assistant assessed participants on the psychosocial measures and demographics. A questionnaire was used to assess demographic variables (age, level of education, socio-economic status, offending status, history of substance use), and family characteristics (single parenting, inadequate discipline). The duration of assessment for each participant was approximately 1.5 hours. In view of this, two participants were called at a time, to prevent class disruption. There were 15 minutes of scheduled breaks in-between sessions usually around the school's lunchtime or when the participants clearly expressed fatigue. A total number of four participants were tested each day for 5 days in a week (excluding holidays). After assessing each of the participants, a notepad was given to them as compensation for their time and effort.

At the Senior Correctional Centre, the administration provided an empty classroom at the Junior High School for detainees to be used for assessment. Participants were from two groups, those under vocational training and those in the Junior High School. Participants were then selected from the age groups of 14,15,16,17, and 18. The participants below 18 years gave assent to participate in the study and the headmaster of the school provided consent for all participants before the assessment began. Participants were urged to relax usually with the

statement "I am XX, we are going to go through a number of exercises. This is not an exam, so I want you to relax and do your best" The duration of assessment for each participant was approximately 2 hours. In view of this, two participants were called at a time. There were 20 minutes of scheduled breaks in-between sessions usually around the school's lunchtime or when the participants clearly expressed fatigue. Approximately 3-4 participants were assessed each day, 4 times a week (excluding holidays and other events). In instances where participants were unable to complete assessment in a day, we continued the assessment for the same individual the next day before moving on to new participants.

**Data analysis**

The data analyzed was done using the SPSS version 23. The various hypotheses were analyzed using Binary Logistic regression. Binary logistic regression was used because the hypotheses were testing the likelihood of the various independent variables (executive functions, memory, attention, verbal ability, family structure, family size, socioeconomic status and emotional or behavioral problems) predicting juvenile detention. In addition, the dependent variable was a categorical variable with two categories- children in detention and control group.

**Ethical considerations**

These ethical considerations ensued to protect the interest and welfare of all participants in this study. Ethical clearance was sought from the Ethics Committee for Humanities (ECH) of the University of Ghana, Legon, with ethical clearance number: ECH 021/19-20. The Ghana Prisons Headquarters, the administration of the Senior Correctional Centre, the Ayawaso-East Municipal Assembly and the administration of the various schools in the Kanda Cluster of Schools. Researchers gave consent forms to parents and legal guardians of participants to obtain a written informed consent from legal guardians of child participants and assent from the child participants. Confidentiality and anonymity were assured to all participants of the study. Precautionary measures were put in place to cater for any emotional or psychological

breakdown during assessment. A licensed clinical psychologist was a phone call away in case their expertise was needed. Each participant received a bottle of water and snacks and at the end of the study, each child at the Kanda Cluster of Schools was given a notepad and an amount of money was donated to the Senior Correctional Centre.

# CHAPTER FOUR

# RESULTS

## Introduction

The main aim of this study was to identify the extent to which specific neuropsychological function domains, and psychosocial factors predicted juvenile detention. The Statistical Package for Social Sciences (SPSS) version 23 was used to analyze the data. A total of 84 detained delinquents and 31 controls were used in this study. This chapter presents preliminary analysis and results from hypothesis testing.

## Preliminary data analysis

The data set was screened for missing data and outliers. Data transformation techniques used included changing variables such as family structure, and groups into categories. Total scale scores were computed for some of the measures such as the Digit Span, the Kilifi Naming Test (KNT), the Ravens Standard Progressive Matrices (RPM), Literacy and Numeracy scale, Pair Cancellation, and the Youth Self Report (YSR) scale. In addition, the raw scores of some of the measures were transformed into scaled scores (Digit Span) and standard scores [RPM, Californian Verbal Ability Test-Short Forms (CVLT-SF)] before testing research questions. In addition, before the testing of hypothesis, Kilifi Naming Test, Digit span, Rey recall and the categories of the Modified Card Sorting Test were reverse coded because lower scores on these tests are indicative of functional deficits. Descriptive statistics: means, standard deviations, range, skewness, and kurtosis of each of the measures used are summarized in Table 2.

Executive function was measured using two tests, the Modified Card Sorting test (MCST) and the Trail Making Test (TMT). The MCST is scored on several items but only number of categories achieved and the perseverative error were used as a measure of cognitive

flexibility and inhibition in this present study. Previous studies that used the MCST in delinquent samples used the number of categories achieved and the perseverative errors as measures of cognitive flexibility and inhibition (Muscatello et al., 2014; Seruca & Silva, 2016). The part of B of the TMT was used because the part B is a greater measure of cognitive flexibility and showed greater variability among respondents than the part A (Sukyirun et al., 2016). Two tests measure memory and these are the short and long delayed recall of the CVLTSF, and the delayed recall of the Rey-Osterrieth Complex Figure Drawing Test. Two tests measure attention, the Digit Span from the Wechsler Intelligence Scale for Adults and Children (WAIS-IV/WISC-III), and the Pair Cancellation test from the Woodcock-Johnson test of cognitive ability (WJ-III). The KNT measures verbal ability. The Literacy and Numeracy Test measures academic performance, General Fluid Intelligence was measured with the RPM. Emotional and behavior problems were measured using the YSR scale.

**Table 2**

**Means, Standard Deviation, Range, Skewness and Kurtosis of measures**

| Variable | Mean (S.D) | Minimum | Maximum | Skewness | Kurtosis |
|---|---|---|---|---|---|
| MCat | 2.32 (1.33) | 0 | 7.00 | 1.14 | 1.94 |
| MPe | 10.97 (10.65) | 0 | 41.00 | 1.77 | 2.33 |
| TMT B | 192.35 (99.44) | 0 | 500.00 | 1.00 | 1.42 |
| CVLT SD | -1.18 (1.67) | -4.50 | 2.00 | 0.16 | -0.63 |
| CVLT LD | -1.01 (1.28) | -4.00 | 2.00 | 0.06 | -0.48 |
| REY DR | 15.88 (7.46) | 0.50 | 32.00 | -0.16 | -0.65 |
| DS | 2.94 (2.40) | 1.00 | 12.00 | 1.54 | 2.28 |
| PC | 72.10 (10.48) | 49.00 | 94.00 | -0.23 | -0.65 |
| LIT | 3.21 (2.06) | 0 | 6.00 | -0.27 | -1.28 |

| | | | | | |
|---|---|---|---|---|---|
| NUM | 2.76 (1.05) | 0 | 5.00 | 0.55 | 0.05 |
| RPM | 21.04 (6.81) | 8.00 | 44.00 | 0.98 | 1.25 |
| KNT | 62.40 (15.29) | 8.00 | 96.00 | -0.60 | 1.05 |
| AD | 11.39 (4.17) | 0 | 24.00 | 0.19 | 0.44 |
| WD | 7.75 (3.16) | 0 | 14.00 | -0.04 | -0.22 |
| SC | 6.93 (5.02) | 0 | 18.00 | 0.35 | -1.07 |
| TP | 5.59 (3.38) | 0 | 16.00 | 0.77 | 0.51 |
| AP | 8.97 (3.53) | 0 | 16.00 | -0.36 | -0.59 |
| SP | 5.74 (3.40) | 0 | 16.00 | 0.61 | 0.26 |
| RBB | 10.77 (4.70) | 0 | 24.00 | 0.48 | 0.11 |
| A | 9.98 (5.50) | 0 | 31.00 | 0.85 | 0.98 |

*N=115. MCat=Modified Card Sorting Categories; MPe=Modified Card Sorting Perseverative errors; TMT B=Trail Making Test part B; CVLT SD=Californian Verbal Learning Test Short Delayed recall; CVLT LD= Californian Verbal Learning Test Long Delayed recall; REY DR=Rey Complex Figure Delayed recall. DS=Digit Span PC=Pair Cancellation; LIT=Literacy; NUM=Numeracy; RPM=Raven's Standard Progressive Matrices; KNT=Kilifi Naming Test; AD=Anxious/Depressed; WD=Withdrawn/Depressed; SC=Somatic Complaints; TP=Thought Problems; AP=Attention problems; SP=Social Problems; RBB=Rule Breaking Behavior; A=Aggression*

In Table 2, the skewness and kurtosis for the various measures fell within range of –0.60 to +2.33. According to Garson (2012), a data is normally distributed when the skewness and kurtosis fall within the range of -3 to +3. In addition, the mean and standard deviation for the Trail Making Test part B is high because this particular neuropsychological test was scored in seconds, the amount of time a participants takes to complete the trail. The CVLT SD and LD are transformed into standard scores. Bivariate correlations between all neuropsychological tests and emotional and behavior problems were performed. According to Pallant (2011),

correlations among independent variables when performing logistic regressions should not exceed. 80. Results are presented in Table 3 and Table 4.

**Table 3**

**Summary of bivariate correlations between tests of all neuropsychological function domains**

| Variable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.MCat | - | | | | | | | | | | | |
| 2.MPe | -0.43** | - | | | | | | | | | | |
| 3.TMT B | -0.20* | 0.00 | - | | | | | | | | | |
| 4.CVLT SD | 0.30** | -0.11 | -0.26** | - | | | | | | | | |
| 5.CVLT LD | 0.33** | -0.11 | -0.20* | 0.79** | - | | | | | | | |
| 6.REY DR | 0.30** | -0.05 | -0.22* | 0.21* | 0.20* | - | | | | | | |
| 7.DS | 0.24** | -0.12 | -0.20* | 0.28** | 0.23* | 0.13 | - | | | | | |
| 8.PC | 0.19* | -0.32** | -0.23* | 0.25** | 0.25** | 0.12 | 0.21* | - | | | | |
| 9.KNT | 0.01 | -0.03 | 0.05 | 0.19* | 0.15 | 0.12 | -0.05 | 0.10 | - | | | |
| 10.LIT | 0.36** | -0.25** | -0.38** | 0.34** | 0.29** | 0.22* | 0.36** | 0.54** | 0.02 | - | | |
| 11.NUM | 0.34** | -0.23* | -0.26** | 0.27** | 0.32** | 0.44** | 0.40** | 0.32** | 0.18 | 0.50** | - | |
| 12.RPM | 0.38** | -0.20* | -0.24** | 0.22* | 0.23* | 0.42** | 0.36** | 0.21** | 0.08 | 0.37** | 0.48** | - |

*N=115 *correlation significant at the 0.05 level, ** correlation significant at 0.01 level, 1=Modified Card Sorting Categories; 2=Modified Card Sorting Perseverative errors; 3=Trail Making Test part B; 4=Californian Verbal Learning Test Short Delayed recall; 5= Californian Verbal Learning Test Long Delayed recall; 6=Rey Complex Figure Delayed recall. 7=Digit Span; 8=Pair Cancellation; 9=Kilifi Naming Test; 10=Literacy skills; 11=Numeracy skills; 12=Raven's Progressive Matrices*

**Table 4**

**Summary of bivariate correlations between emotional and behavior problems of the Youth Self-Report scale**

| Variable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| 1.AD | - | | | | | | | |
| 2.WD | 0.47* | - | | | | | | |
| 3.SC | 0.52** | 0.47** | - | | | | | |
| 4.TP | 0.39** | 0.13 | 0.34** | - | | | | |
| 5.AP | 0.51** | 0.38** | 0.55** | 0.39** | - | | | |
| 6.SP | 0.45** | 0.38** | 0.46** | 0.36** | 0.42** | - | | |
| 7.RBB | 0.42** | 0.29** | 0.32** | 0.28** | 0.38** | 0.38 | - | |
| 8.AG | 0.25** | -0.04 | 0.16 | 0.36** | 0.25** | 0.27** | 0.39** | - |

*N=115 *p-value<0.05 level, **p-value<0.01 1=Anxious/Depressed; 2=Withdrawn/Depressed; 3=Somatic Complaints; 4=Thought Problems; 5=Attention problems; 6=Social Problems; 7=Rule Breaking Behavior; 8=Aggression*

**Table 5.**

**Summary of Chi tests for association between demographic variables and group membership**

| Variables | | Control group | | Juveniles in detention | |
|---|---|---|---|---|---|
| | | N | (%) | N | (%) |
| General Fluid Intelligence | | $x^2$=5.47, $p$>0.05 | | | |
| | Below 50th percentile | 24 | (23.5) | 78 | (76.5) |
| | 50th -60th percentile | 4 | (57.1) | 3 | (42.9) |
| | Above 60th percentile | 3 | (50.0) | 3 | (50.0) |
| Age groups | | $x^2$=4.15, $p$<0.05 | | | |
| | 14-16 years | 18 | (36.7) | 31 | (63.3) |
| | 16.1 + years | 13 | (19.7) | 53 | (80.3) |
| Family size | | $x^2$=9.23, $p$<0.01 | | | |
| | Small family | 28 | (35.4) | 51 | (64.6) |
| | Large family | 3 | (8.3) | 33 | (91.7) |
| Socio-economic status | | $x^2$=0.91, $p$>0.05 | | | |
| | Low status | 30 | (28.0) | 77 | (72.0) |
| | High status | 1 | (12.5) | 7 | (87.5) |
| History of substance use | | $x^2$=26.30, $p$<0.01 | | | |
| | Yes | 0 | (0.0) | 44 | (100.0) |
| | No | 31 | (43.7) | 40 | (56.3) |
| Family structure | | $x^2$=3.97, $p$>0.05 | | | |

| | | | | |
|---|---|---|---|---|
| Single parent | 11 | (19.3) | 46 | (80.7) |
| Both parents | 12 | (38.7) | 19 | (61.3) |
| Other | 8 | (29.6) | 19 | (70.4) |

Pearson Correlation was performed to analyze the relationship among the various neuropsychological tests. In Table 3, as expected, within the executive function domain, there was a significant negative correlation between Trail Making Test and number of categories for the Modified Card Sorting test [r (115) =-0.20, $p$<0.05 (2 tailed)]. This means that poor performance on the Trail Making Test was related to poor performance on the number of categories. Within memory domains, in Table 3, a significant positive correlation was found between the Californian Verbal learning Test and the Rey recall [r (115) =0.20, $p$<0.05 (2 tailed)]. This implies that poor performance on the Californian Verbal learning Test relates to poor performance on the Rey delayed recall. In the attention domain, as expected there was a significant positive relationship between scores on the Digit span and the Pair cancellation test [r (115) =0.21, $p$<0.05 (2 tailed)]. This implies that high scores on the Digit span test was related to high scores on the Pair cancellation test.

In Table 3, a significant positive relationship was found between scores on the CVLT short delay and the number of categories on the MCST [r (115) = 0.30, $p$<0.001 (2 tailed)]. A significant positive relationship was found between scores on the CVLT long delay and the number of categories on the MCST [r (115) = 0.33, $p$<0.001 (2 tailed)] and scores on the Rey delayed recall and MCST categories achieved MCST [r (115) = 0.33, $p$<0.001 (2 tailed)]. This suggests that memory is related to executive functions to some extent. A significant positive relationship was found between scores on the Digit span test and the Californian Verbal learning Test [r (115) = 0.28, $p$=0.01 (2 tailed)] suggests that memory and attention are related cognitive functions. Scores of the Raven's progressive matrices were significantly correlated with literacy skills [r (115) = 0.37, $p$<0.001 (2 tailed)] and numeracy skills [r (115) = 0.48, $p$<0.001 (2 tailed)]. This suggests that intelligence is moderately related with academic performance.

In Table 4 among emotional and behavior problems, there was significant positive relationship between anxious/depressed and withdrawn/depressed [r (115) = 0.47, $p$=0.05 (2 tailed)], somatic complaints [r (115) = 0.52, $p$<0.001 (2 tailed)] and thought problems [r (115) = 0.39, $p$=0.01 (2 tailed)]. In addition, anxious/depressed was significantly correlated with attention problems [r (115) = 0.51, $p$<0.01 (2 tailed)], social problems [r (115) = 0.45, $p$<0.01 (2 tailed)], rule breaking behavior [r (115) = 0.42, $p$=0.01 (2 tailed)], and aggression [r (115) = 0.25, $p$<0.01 (2 tailed)]. This shows that the sub-dimensions of the Youth Self Report scale are interrelated albeit to a moderate degree.

In Table 5, among the demographic variables of interest, age groups, family size and history of substance use were significantly associated with either being in juvenile detention or in the control group. A history of substance use (100%, $x^2$=26.30, $p$<0.01) was significantly associated with juvenile detention than those without a history of substance use. Older adolescent age groups (80.3%, $x^2$=4.15, $p$<0.05) was significantly related to being juvenile detention than younger adolescent age groups. Being in a large family (91.7%, $x^2$=9.23, $p$<0.01) was significantly associated with juvenile detention compared to those from a smaller family size.

**Hypothesis Testing**

The various hypotheses were tested using the Logistic regression. The main aim of this study was to assess the extent to which neuropsychological functions, family factors and emotional/behavior problems predict the likelihood of detention. Hence, the logistic regression was the most appropriate analysis. In this study, the dependent variable was a categorical variable-juvenile in detention and matched controls and the independent variables were neuropsychological tests, family factors and emotional behavioral problems.

The first major hypothesis was to assess neuropsychological function domains such as executive functions, memory, attention, and verbal ability predicts the likelihood of juvenile detention. The second hypothesis was to assess likelihood that family factors such as socioeconomic status, family structure (categorized as single parent families, both parent families and others) and family size will predict juvenile detention. The third hypothesis tests the extent to which emotional and behavior problems predicts the likelihood of juvenile detention. To control for the effect of maturation, age, academic performance, and general fluid intelligence were used as covariates in each analysis.

***Hypothesis 1: Poor neuropsychological functioning (executive functions, memory, attention, and verbal ability) would increase the likelihood of being in juvenile detention.***

A binary logistic regression was performed to assess the extent to which scores on all neuropsychological tests would predict the likelihood of juvenile detention, controlling for age, academic performance, and general fluid intelligence. Nine independent variables were used: MCST Categories and Perseverative error, TMT part B, CVLT Short and Long delayed recall, Rey Delayed recall, Digit span, Pair cancellation, and the KNT. The dependent variable was the group-juveniles in detention and matched controls. Preliminary assumption testing indicated that no serious violations of normality, multivariate outliers, and multicollinearity occurred. There was a good fit, meaning that the model was able to predict the likelihood of detention based on performance on all neuropsychological tests [$x^2$ (13, N= 115) = 73.10, $p$<0.001]. In addition, the Hosmer and Lemeshow test was not significant ($p$>0.05). The model also explained between 47.3% (Cox & Snell R Square) and 68.6% (Nagelkerke R Square) of the variance in the outcome. Results are summarized in Table 6.

**Table 6**

**Summary of Logistic regression for neuropsychological measures and juvenile detention**

| Variable | *B* | Wald $x^2$ test | OR [95% CI] |
|---|---|---|---|
| **AGE** | 1.01** | 7.55 | 2.75 [1.34,5.66] |
| **Academic Performance-LIT** | 1.25*** | 13.58 | 3.47 [1.79, 6.74] |
| **Academic Performance-NUM** | -0.22 | 0.28 | 0.80 [0.35, 1.82] |
| **GFI** | 2.13 | 1.29 | 8.40 [0.21,329.11] |
| **Executive Function-MCat** | 0.52 | 3.15 | 1.68 [0.95, 2.99] |
| **Executive Function-MPe** | -0.02 | 0.21 | 0.98 [0.91,1.06] |
| **Executive Function-TMT B** | 0.00 | 0.72 | 1.00 [0.99,1.01] |
| **Memory-CVLT SD** | -0.04 | 0.01 | 0.96 [0.51,1.81] |
| **Memory-CVLT LD** | 0.03 | 0.00 | 1.03 [0.42,2.53] |
| **Memory-REY DR** | -0.03 | 0.28 | 0.97 [0.86,1.09] |
| **Attention-DS** | -0.10 | 0.34 | 0.90 [0.64,1.28] |
| **Attention-PC** | -0.06 | 1.60 | 0.95 [0.87,1.03] |
| **Verbal Ability-KNT** | 0.07* | 5.01 | 1.07 [1.01, 1.14] |
| **Constant** | -18.60 | 8.33 | |

Note: *$p$<0.05,**$p$<0.01,***$p$<0.001. *MCat=Modified Card Sorting Categories; MPe=Modified Card Sorting Perseverative errors; TMT B=Trail Making Test Part B; CVLT SD=Californian Verbal Learning Test Short Delayed recall; CVLT LD= Californian Verbal Learning Test Long Delayed recall; REY DR=Rey Complex Figure Delayed recall. DS=Digit Span PC=Pair Cancellation; LIT=Literacy; NUM=Numeracy; GFI=General Fluid Intelligence; KNT=Kilifi Naming Test. Hosmer and Lemeshow test p>0.05*

Executive functions

Two tests measure executive functions in this study and these are the MCST categories achieved and perseverative error, and the TMT B. Table 6, shows regression coefficients, chi-square tests as well as odds ratios and 95% confidence intervals. In Table 6, after controlling for age, academic performance and general fluid intelligence, performance on the MCST perseverative error did not significantly predict the likelihood of juvenile detention. However, performance on the MCST categories achieved almost doubled the odds of juvenile detention but this did not reach statistical significance. Again, scores on Trail Making Test B increased the odds of juvenile detention by 1 but this also did not reach statistical significance.

Memory

Two tests measure memory in this study and these are the CVLT short and long delayed recall and the Rey Delayed recall. In Table 6, performance on the CVLT short delayed and the Rey delayed recall did not significantly predict the likelihood of juvenile detention. On the other hand, performance on the CVLT long delayed slightly increased the likelihood of juvenile detention but this did not reach statistical significance.

Attention

Two tests measure attention in this study and these are the Digit span and the pair cancellation test. In Table 6, performance on the Digit span and Pair cancellation test did not significantly predict the likelihood of juvenile detention.

Verbal ability

The KNT measured verbal fluency. In Table 6, performance on the KNT significantly predicted the likelihood of being in juvenile detention. The results suggest that, the odds of

being in juvenile detention are slightly greater than 1 for those who performed poorly on the KNT than for those with good performance on the KNT.

The results about neuropsychological functioning partially support the hypothesis that poor neuropsychological functioning increases the likelihood of being detention

***Hypothesis 2: Family factors (socioeconomic status, family structure, family size) would significantly increase the likelihood of juvenile detention.***

A binary logistic regression was performed to assess the extent to which family factors would predict the likelihood of juvenile detention. Three independent variables were used: socioeconomic status, family structure (categorized as single parent, both parent and others) and family size. The dependent variable was the group-juveniles in detention and matched controls. Preliminary assumption testing indicated that no serious violations of normality, multivariate outliers, and multicollinearity occurred. There was a good fit, meaning that the model was able to predict the likelihood of juvenile detention based on responses given [$x^2$ (8, N= 115) = 70.53, p<0.001]. In addition, the Hosmer and Lemeshow test was not significant (p>0.05). The model also explained between 45.8% (Cox & Snell R Square) and 66.6% (Nagelkerke R Square) of the variance in the outcome. Results are summarized in Table 7.

**Table 7**

**Summary of Logistic regression for family factors and juvenile detention**

| Variable | *B* | Wald $x^2$ test | OR [95% CI] |
|---|---|---|---|
| **Age** | 0.84*** | 10.65 | 2.32 [1.40,3.85] |
| **Academic Performance-LIT** | 1.14*** | 13.19 | 3.13 [1.69, 5.81] |
| **Academic Performance-NUM** | -0.15 | 0.17 | 0.86 [0.42,1.76] |
| **GFI** | 0.97 | 0.42 | 2.65 [0.14,50.48] |

| | | | |
|---|---|---|---|
| **SES** | 1.01** | 7.45 | 2.74 [1.33,5.66] |
| **Family Structure** | Reference | Reference | |
| Other | | 0.74 | |
| Single parent | 0.52 | 0.43 | 1.69 [0.35,8.08] |
| Both parent | -0.08 | 0.01 | 0.93 [0.16,5.58] |
| **Family size** | -0.01 | 0.00 | 0.99 [0.70,1.40] |
| Constant | -20.21 | 14.86 | |

*N=115*p*<0.05,***p*<0.01,****p*<0.001. *LIT=Literacy; NUM=Numeracy; GFI=General Fluid Intelligence; SES=Socio economic status; Hosmer and Lemeshow test p>0.05*

Table 7 shows the regression coefficients, chi square tests as well as odds ratio and 95% confidence intervals. In Table 7, among the family factors, socioeconomic status significantly predicted the likelihood of detention. This shows that participants from low socioeconomic status were almost three times more likely to be in juvenile detention than those from high socioeconomic status. However, family size and single parent families did not significantly predict the likelihood of juvenile detention. Therefore, the results about family factors partially supported the hypothesis that family factors increase the likelihood of being in detention.

***Hypothesis 3: Emotional and behavior problems would significantly increase the likelihood of juvenile detention.***

A binary logistic regression was performed to assess the extent to which emotional and behavior problems predicted the likelihood of juvenile detention. Eight independent variables were used: anxious/depressed, withdrawn/depressed, somatic complaints, thought problems, attention problems, social problems, rule breaking behavior and aggression. The dependent variable was the group-juveniles in detention and matched controls. Preliminary assumption

testing indicated that no serious violations of normality, multivariate outliers, and multicollinearity occurred. A test of the full model with all eight predictors was significant, indicating a good fit, [$x^2$ (12, N= 115) = 84.73, p<0.001]. Thus, the model was able to predict the likelihood of juvenile detention based on the responses given. In addition, the Hosmer and Lemeshow test was not significant (p>0.05). The model also explained between 52.1% (Cox & Snell R Square) and 75.7% (Nagelkerke R Square) of the variance in the outcome. Results are summarized in Table 8.

**Table 8**

**Summary of logistics regression for emotional and behavior problems and juvenile detention**

| Variable | *B* | Wald $x^2$ test | OR [95% CI] |
|---|---|---|---|
| **Age** | 0.76* | 5.09 | 2.13 [1.10,4.12] |
| **Academic Performance-LIT** | 1.12*** | 9.95 | 3.08 [1.53, 6.19] |
| **Academic Performance-NUM** | -0.27 | 0.28 | 0.76 [0.28, 2.09] |
| **GFI** | 0.50 | 0.06 | 1.64 [0.03,90.62] |
| **Anxious/Depressed** | -0.05 | 0.17 | 0.95 [0.74,1.22] |
| **Withdrawn/Depressed** | 0.18 | 1.32 | 1.20 [0.88,1.63] |
| **Somatic Complaints** | 0.36** | 6.22 | 1.43 [1.08,1.90] |
| **Social Problems** | 0.24 | 2.13 | 1.27 [0.92,1.75] |
| **Thought Problems** | 0.14 | 0.87 | 1.15 [0.86, 1.53] |
| **Attention Problem** | -0.07 | 0.31 | 0.93 [0.71, 1.21] |
| **Rule breaking Behavior** | 0.39** | 6.19 | 1.48 [1.09,2.02] |
| **Aggression** | 0.12 | 1.35 | 1.21 [0.92, 1.36] |
| Constant | -23.86 | 10.35 | |

*N=115 *p-value<0.05 level, **p-value<0.01, ***p-value<0.001 LIT=Literacy; NUM=Numeracy; GFI=General Fluid Intelligence; Hosmer and Lemeshow test p>0.05*

In Table 8, among the emotional and behavior problems, somatic complaints and rule breaking behavior significantly predicted the likelihood of detention. The results suggest that the odds of currently being in juvenile detention are greater than 1 for those who reported more somatic complaints than for those who reported less somatic complaints. Those who reported high levels of rule breaking behavior had greater odds of being in juvenile detention than those who reported low levels of rule breaking behavior. On the other hand, Table 8 shows that withdrawn/depressed, thought problems, attention problems, and aggression did not significantly predict the likelihood of juvenile detention. Thus, the results about emotional and behavior problems partially supported the hypothesis that high levels of emotional and behavior problems increase the likelihood of juvenile detention.

**Summary of results**

In this study, three hypotheses assessed the extent to which neuropsychological functions, family factors and emotional and behavior problems predict the likelihood of juvenile detention. The summary of the findings is presented as follows:

1. Among the neuropsychological functions, assessed only poor verbal ability increased the odds of juvenile detention even when age, academic performance and intelligence was controlled.
2. Among the family factors, low socioeconomic status increased the likelihood of juvenile detention even when age, academic performance, and intelligence was controlled.
3. Somatic complaints and rule breaking behavior significantly predicted the likelihood of juvenile detention beyond the effects of age, academic performance, and intelligence.

# CHAPTER FIVE

# DISCUSSION

## Introduction

This present study examined the extent to which impaired neuropsychological functions, family factors and emotional and behavior problems predicted the likelihood of juvenile detentions when controlling for the effects of age, school performance and general fluid intelligence. Major findings are discussed below:

## Discussion of findings

### Neuropsychological function as predictors of juvenile detention

It was found that among the neuropsychological functions assessed, only verbal ability predicted the likelihood of juvenile detention even when age, school performance, and intelligence were controlled. To account for the effect of maturation on neuropsychological functioning, age was controlled. In addition, school performance and intelligence were controlled because they are strongly related to performance on cognitive test.

It was found that performance on the MCST categories, MCST perseverative errors and the TMT B did not significantly predict the likelihood of juvenile detention. However, low scores on the number of MCST categories and the TMT B increased the likelihood of juvenile detention but it did not reach statistical significance. Indicating that impaired executive functions was not a predictor of juvenile detention. This finding was unexpected given the fact that majority of the children at the Senior Correctional Centre performed worse on all measures of executive functions with only a few who performed well on the tests. Again, it was found that performance on the CVLT short and long delayed recall and the Rey complex figure

drawing did not significantly predict the likelihood of juvenile detention. Low scores on the CVLT Long delayed recall increased the odds of being in detention but it did not reach statistical significance. This means that impaired memory functions, in both verbal and visual memory, was not a significant predictor of juvenile detention. This was also unexpected given that, majority of children in detention recalled fewer words from the list of words presented in the CVLT. Again, majority of them made more intrusion errors, in the sense that they recalled a higher number of words that were not originally from the list of words presented.

In addition, it was found that performance on tests of attention did not significantly predict the likelihood of juvenile detention. Low scores on the digit span test are an indication of poor auditory attention and low scores on the pair cancellation test is an indication of poor visual attention. This means that impaired attention span was not a significant predictor of juvenile detention. This was also unexpected given that nearly all the participants in detention had lower scores on the Digit span test, and for all the participants, the Digit span test was discontinued. The small sample size in this present study may have accounted for the fact that executive functions, memory, and attention were not significant predictors of juvenile detention. Most of the previous studies that reported impaired neuropsychological deficits as significant predictors of delinquent outcomes and incarceration used larger samples (Lansing et al., 2014; Low & Webster, 2016; Wallinius et al., 2019; Zou et al., 2012). For instance, Zou et al (2012) recruited 214 juvenile male offenders and 107 healthy controls and found that detained delinquents had significant deficits in executive functions and working memory compared to non-delinquent controls. Again, while majority of the juveniles in detention performed worse on all measures of neuropsychological functioning, the general performance of non-delinquent controls was also unsatisfactory. Perhaps, this may have contributed to the non-significant findings across the neuropsychological variables investigated.

On the other hand, it was found that performance on the KNT significantly predicted the likelihood of juvenile detention. An inability to complete the KNT or correctly name objects presented was indicative of poor performance. As expected, poor performance on the KNT more than doubled the odds of juvenile detention. The unique contribution of poor performance on the KNT was found after the effect of age, academic performance and intelligence was controlled. This implies that poor verbal ability was a very significant predictor of juvenile detention. One possible explanation for this finding is that verbal skills are involved in self-regulatory processes such as emotional and behavior control. Adolescents with high verbal ability are usually able to internally regulate emotions and behavior. Consequently, this suggests that adolescents in detention with poor verbal ability were unable to clearly communicate their thoughts, needs, wants and frustrations, which triggered delinquent and antisocial outcomes such as robbery, stealing, defilement, rape and even manslaughter.

This is consistent with previous studies that found language was negatively associated with externalizing behaviors such as aggression and rule breaking behavior (Peterson et al., 2015). This means that low verbal ability increases aggression and rule breaking behavior. On the other hand, low literacy scores could be related to poor verbal ability. It was found that low literacy predicts the likelihood of detention and this could affect both expressive and receptive language skills, including performance on the KNT.

Another possible explanation for low verbal ability is the influence of parental factors such as low parental education and poor supervision. Demographic information showed that most children had parents that were either illiterate or had low educational levels. Ghanaian parents with low educational backgrounds may have less resource at their disposal compared to parents with high educational levels. Probably because these parents have limited use of language, which affects the way they communicate with their children as well as the manner in which they supervise their children's behavior. Thus, parents become less vocally responsive,

which in turn influences the way children are able to express their wants and needs and understand the expression of others. This puts them at-risk for antisocial behavior, delinquency, or worse, incarceration. Previous studies have found that juvenile delinquents in detention evinced poor verbal ability in receptive and expressive and receptive language (Lansing et al., 2014; Manninen et al., 2013; Tung & Chhabra, 2011). In addition, Bellair et al (2016) reported that among offending groups, poor verbal ability in childhood and adolescence significantly more than doubled the odds of persistent offending and arrest outcomes later in life.

Another possible explanation is abnormal frontal lobe functions. Abnormal frontal lobe function is linked with language deficits, particularly because expressive language, speech production, fluency is regulated by the frontal lobes and other subcortical structures. The frontal lobes are known to regulate executive control, memory, attention as well as verbal ability and languages abnormalities reflect a lack of cognitive and behavior control. Low verbal ability, whether in receptive or expressive capacity has been linked to juvenile offending. For instance, Snow and Powell (2011) found that language deficits were strongly associated with offending severity, particularly violent offending. It is possible that some juvenile delinquents at the Senior Correctional Centre may have abnormal brain functions, as shown by their poor performance on intelligence tests: majority of juveniles fell below the 50$^{th}$ percentile on general fluid intelligence. However, brain imaging studies among these populations is need to definitively conclude on abnormal brain functioning among children in detention in Ghana.

**Family factors as predictors of juvenile detention**

It was found that among the family factors, low socioeconomic status predicted the likelihood of juvenile detention. The odds of being in juvenile detention were more than doubled for those from lower socioeconomic status compared to those from higher socioeconomic status even when the effect of age, school performance, and general fluid intelligence were controlled. This implies that family factors are crucial in the developmental

of antisocial outcomes and incarceration. One possible explanation for the relationship between socioeconomic status and detention is that low socio-economic status is related in part to parental education/parental occupation, and parental supervision. Children need much supervision during the formative years and especially during adolescence, where a host of developmental changes occur. Adolescence is also a period where children are more susceptible to impulsive and risky behaviors. A number of children in detention came from poor family backgrounds and had to resort to criminal acts such as stealing and robbery to survive and in Ghana, low socio-economic status has been linked to delinquent behaviors and high school dropouts (Boakye, 2012; Boakye, 2013; Bosiakoh & Andoh, 2010).

Furthermore, the demographic data distribution in Table 1 shows that majority of participants in juvenile detention come from single parent families, where they are poorly supervised. This is consistent with previous research in Ghana that shows single parenting and poor supervision is more likely to lead to delinquency and subsequent arrest (Boakye, 2012). During interviews with participants, it became clear that majority of the parents of delinquents were single parents who worked as farmers or traders. This means that these single parents have the extra burden of taking up more responsibilities to provide for the family, often working for long hours, leaving home early and returning late, leading to unintended consequences such as poor supervision and a lack of discipline after wrongdoing. This in turn increases the risk of juvenile offending and incarceration. The General theory of crime (Gottfredson & Hirschi, 1990) suggests that parents must monitor the behaviors of children, identify wrong behaviors and punish those behaviors to instill a sense of morality in children. Thus, poor parental supervision/lack of discipline after wrongdoing leads to the development of low levels of self-control and engaging in delinquent acts among children, especially during the formative years. Similarly, Rekker et al (2017) found that parents from low socioeconomic backgrounds use less effective monitoring and supervision strategies that makes juvenile delinquency more

likely to occur. In addition, Nisar et al (2015) found that low socioeconomic status and single parenting increased the likelihood of juvenile offending.

Another explanation is that low socioeconomic status creates some kind of "strain" which triggers delinquent behaviors such as stealing and armed robbery as a coping strategy. According to the General Strain theory (Agnew, 2018), low socioeconomic status creates a lack of resources needed to achieve life goals and aspirations, which leads to intense frustrations and negative emotions. This triggers maladaptive coping strategies such as delinquency and analogous behaviors. In this present study, majority of detained delinquents were involved in stealing and robbery prior to arrest. In addition, most of them were from low socioeconomic backgrounds and had dropped out of school at an early stage because of financial constraints. This made them vulnerable to negative peer associations, which ultimately lead to criminal behaviors and subsequent arrest. Research shows that most detained delinquents experience financial constraints that lead to early school dropouts, which they report made them vulnerable to negative peer associations, indulging in substance use and engaging in criminal behaviors prior to arrest (Achakanalli & Kumbhar, 2018; Boakye, 2012; Bosiakoh & Andoh, 2010). Further, studies have shown that juvenile delinquents engage in criminal acts especially stealing and armed robbery in order to provide for themselves and sometimes their families (Boakye, 2013).

On the other hand, it was found out that family structure (Single parent families) and family size did not significantly predict the likelihood of detention. This was unexpected given that most children in detention were from single-parent homes and large families. A possible explanation may be that parenting styles was not measured in this study. It is possible that single-parenting is only significant when considered in light of other factors such as parenting styles and parent-child relationships. Previous research that found a significant relationship between family size, single parent families, and delinquency also included parenting styles and

attachment (Boccio & Beaver, 2019; Nisar et al., 2015; Schroeder et al., 2010; Singh & Kiran, 2014). Further, one study in Nigeria found no significant relationship between single parenting and delinquency. Further, Osiagiee-Obazee and Eduwen (2016) found that single parent family did not significantly predict delinquency; instead, the media and cultural beliefs may be responsible for delinquent outcomes. Similarly, Boakye (2013) indicates that family size, when considered in light of single parenting was not a significant predictor of juvenile offending.

**Emotional and behavior predictors and juvenile detention.**

It was found out that, among the emotional and behavior problems assessed, somatic complaints, and rule breaking behavior increased the likelihood of juvenile detention. This was expected given that those who reported high levels of somatic complaints and rule breaking behavior were more likely to be in detention than those who reported lower levels. Mental health has been associated with delinquency and crime. The YSR subscales are based on the Diagnostic and Statistical Manual (DSM) classification on depression problems, anxiety problems, somatic problems, attention deficits, oppositional defiant problems and conduct problems (Achenbach, 2001). Somatic complaints are usually a sign of underlying psychological problems that no doubt affects physiological functions such as unexplained headaches, backaches etc. During interviews, it was clear that majority of participants came from rough backgrounds. Perhaps, detained delinquents may have experienced high levels of neglect and abuse during childhood, which affects both physical and mental health outcomes in adolescence. This could account for the high levels of self-reported physical symptoms or somatic complaints.

In addition, adverse childhood experiences are linked to increased aggression, violence and rule breaking behavior. This means that when children grow up in abusive/neglectful environments that are not nurturing, the natural developmental process that takes place during

adolescence is disrupted, leading to a host of cognitive, physical and mental health problems and delinquency. Perhaps, these children in detention may have experiences some level of abuse and neglect prior to arrest. This is consistent with research in Ghana that have found that children who grow up in abusive homes run away from home and end up in a life of crime (Dako-Gyeke et al., 2022). Others have found that adverse childhood experiences may influence mental and physical health outcomes, which increases the likelihood of children becoming perpetuators of criminal behaviors (Turner et al., 2020). Similarly, Choi et al (2017) found that detained juveniles showed more emotional and behavior problems such as high somatic complaints, rule breaking behavior and aggression.

In addition, Table 1 shows that majority of detained delinquents had a history of substance use. During the interviews, it was found out that, more of those who had a history of substance use reported a daily and sometimes-weekly frequency of using weed, D10, tramadol/tramol, alcohol etc. prior to arrest. Substance-use has been linked to the development of criminal behavior and vice-versa (Riordan, 2020). Which suggests that frequent indulgence in substances could worsened physical and mental health issues, leading to high levels of somatic complaints and rule-breaking behavior that increased the odds of juvenile detention.

However, results showed that depression, anxiety, attention problems, were not significant predictors of juvenile detention. This was unexpected, given that majority of the children in detention reported high levels of somatic complaints. It is unclear, why depression, anxiety and attention problems, among others were not significant predictors of juvenile detention. Perhaps, they are outcomes of the detention environment and not necessarily predictors. Barnet et al (2016) suggests that incarceration of adolescents for more than a year leads to a host of physical and mental health problems in adulthood. Likewise, Anderson et al (2012) found that depression and anxiety were outcomes of juvenile offending, specifically theft and serious violence rather than antecedents of criminal behavior. This assertion differs

from majority of studies that found that detained delinquents had significantly higher levels of thought problems, depression, anxiety and lower levels of self-esteem than controls even when controlling for the effect of age and gender (Chung et al., 2020).

**Strength of the present study**

This study builds on existing research by assessing both neuropsychological and psychosocial predictors of juvenile detention, whereas most studies on delinquency in Ghana have focused solely on social factors associated with juvenile delinquency. Again, in this study the Literacy and Numeracy Test was used in data collection. This test is a local test that measures school performance based on the Basic School curriculum. To the best of my knowledge this test has not be used in delinquent samples in Ghana.

**Limitations of the present study**

This present research is not without limitations; as such, caution must be applied when interpreting the results of this study. One limitation for this present study was the sample size for both detained delinquents and a matched control. The researcher was only able to obtain a little below half the original sample size projected for data collection. This was because of 1) the limited number of detained delinquents within the age group of interest (14-18years). Detained delinquents were above 18 years and 2) most of the detained delinquents were engaged in the workshop programs at the time of this study. Hence, data was obtained from only those who were available and willing to participate in the study.

Additionally, the recent outbreak of the COVID-19 led to the closure of schools and therefore data collection in the public schools had to be halted. This was beyond the control of the researcher, nevertheless, it affected the projected sample size, resulting in a smaller sample, which reduced the power of the statistical analyses and consequently some unexpected (non-significant) findings. Researchers argue that small sample size may possibly undermine the

external validity of results in a way that prevents generalizations (Fabner & Focenca, 2014). In addition, the cross-sectional design may have influenced the potential direction of effects, as the predictors and outcomes are assessed simultaneously.

Furthermore, the participants at the detention center showed a limited school ability, especially in areas of reading, writing and mathematical skills. Consequently, this affected their ability to read and understand some of the tests. In addition, it was not feasible to interview parents of participants, as this would have shed more light on parenting styles and family practices that can influence cognitive and emotional development of children.

**Recommendations**

Major findings from this study revealed that although impaired memory; attention and executive functions increased the likelihood of juvenile detention were not significant predictors of juvenile detention. It is highly recommended that future studies with a larger sample size examine executive functions, memory, and attention using a variety of measures to confirm whether these neuropsychological functions are truly not significant predictors of delinquency.

Poor performances on nearly all cognitive tests administered especially among participants in the Junior Secondary School at the Senior Correctional Centre suggest that the teaching and learning experience needs to be improved. This is crucial given that some students enrolled in the JHS level are registered to write the upcoming Basic Education Certificate Examination (BECE). Consequently, the teachers at the Basic School at the Senior Correctional Centre need to be well trained and equipped with the necessary skills to handle juvenile delinquents with academic challenges. In addition, the teaching and learning experiences of students in the control group could also be improved, given that the performance of participants in the control group while better than those in juvenile detention was still substandard for

children their age and educational level. Results from this study indicate that teachers in the government Junior High Schools could be trained to identify children who are "at-risk" for antisocial and delinquent outcomes, so that early interventions can be made to change criminal trajectories.

In addition, the main findings from this study support the notion that there are biological underpinnings to juvenile delinquency that manifests as impaired neuropsychological functions in verbal ability among delinquents in Ghana. Hence, it would be useful for the juvenile courts to add neuropsychological screening tests as part of the legal decision-making process. Most developed and some developing countries include neuropsychological evaluations as part of the legal decision-making process (Fabian, 2010; Luna, 2012). Thus, an integration between judicial and psychological interventions will call for comprehensive training of law officials especially the police and prison services on the care and management of juvenile offenders with possible neuropsychological impairments. Currently in Ghana, juvenile court do not include neuropsychological evaluations in the legal decision-making process and research shows that the legal decision-making process is wrought with inadequacies, often to the detriment of the child offender (Osei, 2013)

Consequently, training institutions offering psychology courses, whether at graduate or post-graduate levels, could include training courses on the emotional, cognitive and behavioral problems associated with delinquency and crime. This will go a long way to equip future clinicians, counsellors with well-grounded knowledge and expertise regarding various dimensions of psychological challenges that juvenile delinquents go through.

Finally, the results from this study also indicates that emotional and behavior problems such as somatic complaints and rule-breaking behavior significantly predicted juvenile detention. Thus, clinical psychologists/neuropsychologists could be consulted in the care and

management of juveniles in detention. Interviews conducted with some staff and participants indicate at the time of data collection revealed that juveniles in detention currently do not have access to a psychologist for psychological evaluations and management.

**Conclusion**

This thesis provides evidence in support of impaired neuropsychological functions among detained delinquents as well some family factors and emotional and behavioral problems that increase the likelihood of juvenile offending.

## REFERENCES

Abrah, P. B. (2019). Labeling Theory and Life Stories of Juvenile Delinquents Transitioning Into Adulthood. *International Journal of Offender Therapy and Comparative Criminology*, *63*(2), 179–197. https://doi.org/10.1177/0306624X18787303

Achakanalli, V. C., & Kumbhar, S. I. (2018). Socio-Economic Factors Responsible for Increasing Juvenile Delinquency and Various Rehabilitative Measures of Government. *Www.Srjis.Com PEER REVIEWED JOURNAL*, *6*(1960). www.srjis.com

Adjorlolo, S., & Egbenya, D. L. (2016). Executive functioning profiles of adult and juvenile male sexual offenders: A systematic review. *Journal of Forensic Psychiatry and Psychology*, *27*(3), 349–375. https://doi.org/10.1080/14789949.2016.1141431

Agnew, R. (2018). Building on the Foundation of General Strain Theory. *Recent Developments in Criminological Theory*, *38*(4), 311–354. https://doi.org/10.4324/9781315089089-22

Alshammari, A. A. (2017). The Role of Socioeconomic Status, Strain, Parental, and Peer Influence on Delinquency Among African-American. *ProQuest Dissertations and Theses*, *December*.

Anderson, D. M., & Anderson, D. M. (2012). *Youth Depression and Future Criminal Behavior Youth Depression and Future Criminal Behavior*. *6577*.

Badiora, A. I. (2015). *Neighborhood Characteristics in Criminal Offending Among Nigerian Juveniles*. *2001*, 452–467. https://doi.org/10.1080/10911359.2014.983256

Baglivio, M. T., Wolff, K. T., Piquero, A. R., DeLisi, M., & Vaughn, M. G. (2017). Multiple Pathways to Juvenile Recidivism: Examining Parental Drug and Mental Health Problems, and Markers of Neuropsychological Deficits Among Serious Juvenile Offenders. *Criminal Justice and Behavior*, *44*(8), 1009–1029. https://doi.org/10.1177/0093854817714810

Baglivio, M. T., Wolff, K. T., Piquero, A. R., & Epps, N. (2015). The Relationship between Adverse Childhood Experiences (ACE) and Juvenile Offending Trajectories in a Juvenile Offender Sample. *Journal of Criminal Justice*, *43*(3), 229–241. https://doi.org/10.1016/j.jcrimjus.2015.04.012

Baird, G., Dworzynski, K., Slonims, V., & Simonoff, E. (2010). Memory impairment in children with language impairment. *Developmental Medicine and Child Neurology*, *52*(6), 535–540. https://doi.org/10.1111/j.1469-8749.2009.03494.x

Balogun, S. K., & Chukwumezie, M. (2010). Influence of Family Relationship, Parenting Style and Self-Esteem on Delinquent Behaviour Among Juveniles in Remand Homes. *Global Journal of Human Social Science GJHSS Classification-C (FOR)*, *46*(2), 170110.

Barnert, E. S., Dudovitz, R., Nelson, B. B., Coker, T. R., Biely, C., Li, N., & Chung, P. J. (2017). How Does Incarcerating Young People Affect Their Adult Health Outcomes? *Pediatrics*, *139*(2), e20162624. https://doi.org/10.1542/peds.2016-2624

Barnie, A. J., Nyarko, A. S., Dapaah, J. M., Appiah, S. C. Y., & Awuviry-Newton, K. (2017). Understanding Youth Violence in Kumasi: Does Community Socialization Matter? A

Cross-Sectional Study. *Urban Studies Research*, *2017*, 1–10. https://doi.org/10.1155/2017/1565602

Bellair, P. E., McNulty, T. L., & Piquero, A. R. (2016a). Verbal Ability and Persistent Offending: A Race-specific Test of Moffitt's Theory. *Justice Quarterly*, *33*(3), 455–480. https://doi.org/10.1080/07418825.2014.918166

Bellair, P. E., McNulty, T. L., & Piquero, A. R. (2016b). Verbal Ability and Persistent Offending: A Race-specific Test of Moffitt's Theory. *Justice Quarterly*, *33*(3), 455–480. https://doi.org/10.1080/07418825.2014.918166

Boakye, A. O. (2012). *Juvenile delinquency in Ghana: a qualitative study of the lived experiences of young offenders in Accra*. *May*, 1–129.

Boakye, K. E. (2013). Correlates and predictors of juvenile delinquency in Ghana. *International Journal of Comparative and Applied Criminal Justice*, *37*(4), 257–278. https://doi.org/10.1080/01924036.2013.792149

Boccio, C. M., & Beaver, K. M. (2019). The Influence of Family Structure on Delinquent Behavior. *Youth Violence and Juvenile Justice*, *17*(1), 88–106. https://doi.org/10.1177/1541204017727836

Borrani, J. B. (2011). *Universidad Autónoma de Nuevo León Facultad de Psicología Jorge Benjamín Borrani Valdés*.

Borrani, J., Frías, M., Alemán, B., García, A., Ramírez, C., & Valdez, P. (2019). Neuropsychological disorders in juvenile delinquents. *Revista Mexicana de Neurociencia*, *20*(5), 244–252. https://doi.org/10.24875/rmn.19000064

Bosiakoh, T. A., & Andoh, P. K. (2010). *Differential association theory and juvenile delinquency in Ghana ' s capital city - Accra : The case of Ghana borstal institute*. *2*(November), 198–205.

Burton, D., Demuynck, S., & Yoder, J. R. (2016). *Executive Dysfunction Predicts Delinquency But Not Characteristics of Sexual Aggression Among Adolescent Sexual Offenders*. https://doi.org/10.1177/1079063214556357

Chung, Y. R., Hong, J. W., Kim, B. B., Kim, J. S., Noh, I. S., Wee, J. H., Kim, N. H., Bae, S. M., & Lim, M. H. (2020). ADHD, suicidal ideation, depression, anxiety, self-esteem, and alcohol problem in Korean juvenile delinquency. *Medicine*, *99*(11), e19423. https://doi.org/10.1097/MD.0000000000019423

Coleman, N. (2014). *YOUTH DELINQUENCY What roles do family structures and family practices What roles do family structures and family practices play ? Criminology with Forensic Psychology October 2013*. *October 2013*, 0–37.

Crowder, J. A., & Carbone, J. (2011). Recombinant knowledge relativity threads for contextual knowledge storage. *Proceedings of the 2011 International Conference on Artificial Intelligence, ICAI 2011*, *1*, 281–287.

Dako-Gyeke, M., Adam, A., & Mills, A. A. (2022). The Quagmire of Juvenile Delinquency: Perspectives of Inmates and Officers in a Correctional Facility in Accra, Ghana. *Deviant Behavior*, *43*(2), 241–257. https://doi.org/10.1080/01639625.2020.1808770

Darkwa, F., & Abass, A. (2016). *" It All Has to Do with Poor Parental Care ": Exploring the Predisposing Factors of Juvenile Delinquency in Ghana*. *4531*(May 2017), 151–166.

DeLisi, M., Umphress, Z. R., & Vaughn, M. G. (2009). The criminology of the amygdala. *Criminal Justice and Behavior*, *36*(11), 1241–1252. https://doi.org/10.1177/0093854809343119

DeLisi, M., & Vaughn, M. G. (2011). the Importance of Neuropsychological Deficits Relating To Self-Control and Temperament To the Prevention of Serious Antisocial Behavior. *International Journal of Child, Youth and Family Studies*, *2*(1/2), 12. https://doi.org/10.18357/ijcyfs21/220115425

Diamond, A. (2013). Executive functions. *Annual Review of Psychology*, *64*, 135–168. https://doi.org/10.1146/annurev-psych-113011-143750

Duruji, C. U., & Onyekachi, U. (2015). *Family Instability and Juvenile Delinquency in Nigeria : A Study of Owerri Municipality*. *20*(1), 40–45. https://doi.org/10.9790/083720154045

Elechi, S. A., & Uriah, O. A. (2018). Single-Parenthood and Juvenile Delinquency Among Secondary School Students in Rivers State. *International Journal of Scientific Research in Education*, *11*(2), 292–317.

Fabian, J. M. (2010). Neuropsychological and neurological correlates in violent and homicidal offenders: A legal and neuroscience perspective. *Aggression and Violent Behavior*, *15*(3), 209–223. https://doi.org/10.1016/j.avb.2009.12.004

Falk, A. E., Lee, S. S., & Chorpita, B. F. (2017). Differential Association of Youth AttentionDeficit/Hyperactivity Disorder and Anxiety With Delinquency and Aggression. *Journal of Clinical Child and Adolescent Psychology*, *46*(5), 653–660. https://doi.org/10.1080/15374416.2015.1055858

Fields, K. N. (2017). Teasing Apart The Roles of Antisocial Traits, Intelligence and Working Memory in Juvenile Delinquency. *ProQuest Dissertations and Theses.*

Glenn, A. L., & Raine, A. (2014). Neurocriminology: Implications for the punishment, prediction and prevention of criminal behaviour. *Nature Reviews Neuroscience*, *15*(1), 54–63. https://doi.org/10.1038/nrn3640

Gyansah, S. T., Soku, R., & Esilfie, G. (2015). Child Delinquency and Pupils' Academic Performance in Fumesua Municipal Assembly Primary School in the Ejisu-Juaben Municipality, Ashanti Region, Ghana. *Journal of Education and Practice*, *6*(12 PG-107–120), 107–120. https://search.proquest.com/docview/1773218031?accountid=10673 NS-

Henry, L. A., & Bettenay, C. (2010). The Assessment of Executive Functioning in Children. *Child and Adolescent Mental Health*, *15*(2), 110–119. https://doi.org/10.1111/j.14753588.2010.00557.x

Hoffmann, J. P. (2018). Academic Underachievement and Delinquent Behavior. *Youth and Society*, 1–28. https://doi.org/10.1177/0044118X18767035

Hoffmann, J. P., Erickson, L. D., & Spence, K. R. (2013). Modeling The Association Between Academic Achievement And Delinquency: An Application Of Interactional Theory. *Criminology*, *51*(3), 629–660. https://doi.org/10.1111/1745-9125.12014

Iselin, A. M. R., & DeCoster, J. (2012). Unique relations of age and delinquency with cognitive control. *Journal of Adolescence*, *35*(2), 367–379. https://doi.org/10.1016/j.adolescence.2011.08.004

Jackson, D. B., & Beaver, K. M. (2016). The Interplay Between Neuropsychological Deficits and Adverse Parenting in the Prediction of Adolescent Misconduct: A Partial Test of the Generalizability of Moffitt's Theory. *Criminal Justice and Behavior*, *43*(11), 1505–1521. https://doi.org/10.1177/0093854816651906

Jacob, L., Haro, J. M., & Koyanagi, A. (2019). Association between intelligence quotient and violence perpetration in the English general population. *Psychological Medicine*, *49*(8), 1316–1323. https://doi.org/10.1017/S0033291718001939

Johnson, V. A., Kemp, A. H., Heard, R., Lennings, C. J., & Hickie, I. B. (2015). Childhoodversus adolescent-onset antisocial youth with conduct disorder: Psychiatric illness, neuropsychological and psychosocial function. *PLoS ONE*, *10*(4), 1–17. https://doi.org/10.1371/journal.pone.0121627

Jolliffe, D., Farrington, D. P., Brunton-Smith, I., Loeber, R., Ahonen, L., & Palacios, A. P. (2019). Depression, anxiety and delinquency: Results from the Pittsburgh Youth Study. *Journal of Criminal Justice*, *62*(October), 42–49. https://doi.org/10.1016/j.jcrimjus.2018.08.004

Kramers-Olen, A. L. (2015). Neuroscience, moral development, criminal capacity, and the Child Justice Act: Justice or injustice? *South African Journal of Psychology*, *45*(4), 466–479. https://doi.org/10.1177/0081246315603633

Lansing, A. E., Washburn, J. J., Abram, K. M., Thomas, U. C., Welty, L. J., & Teplin, L. A. (2014). Cognitive and Academic Functioning of Juvenile Detainees: Implications for Correctional Populations and Public Health. *Journal of Correctional Health Care*, *20*(1), 18–30. https://doi.org/10.1177/1078345813505450

Lengenfelder, J., Arjunan, A., Chiaravalloti, N., Smith, A., & Deluca, J. (2015). Assessing frontal behavioral syndromes and cognitive functions in traumatic brain injury. *Applied Neuropsychology:Adult*, *22*(1), 7–15. https://doi.org/10.1080/23279095.2013.816703

Ling-Teo, S., & Jiar-Yeo, K. (2017). Working Memory and Behavioural Problems in Relation to Malay Writing of Primary School Children. *International Journal of Evaluation and Research in Education (IJERE)*, *6*(3), 189. https://doi.org/10.11591/ijere.v6i3.8136

Ling, S., Umbach, R., & Raine, A. (2019). Biological explanations of criminal behavior. *Psychology, Crime & Law*, *25*(6), 626–640. https://doi.org/10.1080/1068316x.2019.1572753

Low, J. A., & Webster, L. (2016). Attention and Executive Functions as Mediators of Attachment and Behavior Problems. *Social Development*, *25*(3), 646–664. https://doi.org/10.1111/sode.12166

Manninen, M., Lindgren, M., Huttunen, M., Ebeling, H., Moilanen, I., Kalska, H., Suvisaari, J., & Therman, S. (2013). Low verbal ability predicts later violence in adolescent boys with serious conduct problems. *Nordic Journal of Psychiatry*, *67*(5), 289–297. https://doi.org/10.3109/08039488.2012.738245

McGloin, J. M., & Thomas, K. J. (2019). Peer Influence and Delinquency. *Annual Review of Criminology*, *2*(1), 241–264. https://doi.org/10.1146/annurev-criminol-011518-024551

Meijers, J., Harte, J. M., Meynen, G., & Cuijpers, P. (2017). Differences in executive functioning between violent and non-violent offenders. *Psychological Medicine*, *47*(10),

1784–1793. https://doi.org/10.1017/S0033291717000241

Mestre, A. L., Vidal, E. M., & García, P. S. (2017). Depresión y agresividad en adolescentes delincuentes y no delincuentes. Antecedentes: la conducta adolescente está. *Psicothema*, *29*(2), 197–203. https://doi.org/10.7334/psicothema2016.276

Morais, H. B., Joyal, C. C., Alexander, A. A., Fix, R. L., & Burkhart, B. R. (2016). The Neuropsychology of Adolescent Sexual Offending: Testing an Executive Dysfunction Hypothesis. *Sexual Abuse: Journal of Research and Treatment*, *28*(8), 741–754. https://doi.org/10.1177/1079063215569545

Moshkani, M., Mousazadeh, H., & Karimi-rad, S. (2017). Comparison of the analytical capacity of general, verbal, performance intelligence and its subscales and academic achievement between criminal and non-criminal juveniles. *Journal of Fundamentals of Mental Health*, *19*(special issue), 147–152.

Murray, J., & Farrington, D. P. (2010). Key findings from longitudinal studies. *The Canadian Journal of Psychiatry*, *55*(10), 633–642.

Muscatello, M. R. A., Scimeca, G., Pandolfo, G., Micò, U., Romeo, V. M., Mallamace, D., Mento, C., Zoccali, R., & Bruno, A. (2014). Executive functions and basic symptoms in adolescent antisocial behavior: A cross-sectional study on an Italian sample of late-onset offenders. *Comprehensive Psychiatry*, *55*(3), 631–638. https://doi.org/10.1016/j.comppsych.2013.11.015

Nisar, M., Ullah, S., Ali, M., & Alam, S. (2015). Juvenile Delinquency: The Influence of Family, Peer and Economic Factors on Juvenile Delinquents. *Scientia Agriculturae*, *9*(1). https://doi.org/10.15192/pscp.asr.2015.9.1.3748

Ntim, S., & Manu, M. O. (2019). *Delinquent Behaviour as Dissociation between Prescribed Aspirations and Socially Structured Avenues: The Case of Stronger Social Bonding and Secure Attachments*. *May*, 28–39. https://doi.org/10.5923/j.ijap.20190901.04

Nyongesa, M. K., Ssewanyana, D., Mutua, A. M., Chongwo, E., Scerif, G., Newton, C. R. J. C., & Abubakar, A. (2019). Assessing executive function in adolescence: A scoping review of existing measures and their psychometric robustness. *Frontiers in Psychology*, *10*(MAR). https://doi.org/10.3389/fpsyg.2019.00311

Oh, D. L., Jerman, P., Silvério Marques, S., Koita, K., Purewal Boparai, S. K., Burke Harris, N., & Bucci, M. (2018). Systematic review of pediatric health outcomes associated with childhood adversity. *BMC Pediatrics*, *18*(1). https://doi.org/10.1186/s12887-018-1037-7

Osei, A. B. (2013). *Evaluating the effectiveness of Ghana's Juvenile Justice system in rehabilitating the offender*.

Owusu, G., Oteng-Ababio, M., Owusu, A., & Wrigley-Asante, C. (2016). Can Poor Neighbourhoods be Correlated with Crime? Evidence from Urban Ghana. *Ghana Journal of Geography*, *8*(1), 11–31.

Petersen, I. T., Bates, J. E., & Staples, A. D. (2015). The Role of Language Ability and SelfRegulation in the Development of Inattentive-Hyperactive Behavior Problems. *Dev Psychopathol.*, *27*(913), 221–237. https://doi.org/10.1017/S0954579414000698.AH

Quansah, E., & Karikari, T. K. (2016). Neuroscience-related research in ghana: A systematic evaluation of direction and capacity. *Metabolic Brain Disease*, *31*(1), 11–24.

https://doi.org/10.1007/s11011-015-9724-7

Rabinovici, G. D., Stephens, M. L., & Possin, K. L. (2015). Executive dysfunction. *CONTINUUM Lifelong Learning in Neurology*, *21*(3), 646–659. https://doi.org/10.1212/01.CON.0000466658.05156.54

Rekker, R., Keijsers, L., Branje, S., Koot, H., & Meeus, W. (2017). The interplay of parental monitoring and socioeconomic status in predicting minor delinquency between and within adolescents. *Journal of Adolescence*, *59*, 155–165. https://doi.org/10.1016/j.adolescence.2017.06.001

Riordan, K. (2020). Edith Cowan University. *The Grants Register 2021*, 344–345. https://doi.org/10.1057/978-1-349-95988-4_335

Sarfo, J. O. (2016). *Role of Clinical Neuropsychologists in the Evaluation and Management of Diabetes Mellitus in Ghana : A Position Statement*. *October 2014*.

Sarfo, J. O., & Mate-Kole, C. C. (2014). Type 2 Diabetes Mellitus, Depression and Neuropsychological Profiles Among Adults in Ghana. *European Journal of Medicine. Series B*, *1*(1), 44–51. https://doi.org/10.13187/ejm.s.b.2014.1.44

Savage, J., Ferguson, C. J., & Flores, L. (2017). The effect of academic achievement on aggression and violent behavior: A meta-analysis. *Aggression and Violent Behavior*, *37*(February), 91–101. https://doi.org/10.1016/j.avb.2017.08.002

Schroeder, R. D., Osgood, A. K., & Oghia, M. J. (2010). Family transitions and juvenile delinquency. *Sociological Inquiry*, *80*(4), 579–604. https://doi.org/10.1111/j.1475682X.2010.00351.x

Semrud-Clikeman, M., & Ellison, P. A. T. (2009). *Neuropsychology*. https://doi.org/10.1007/978-0-387-88963-4

Seruca, T., & Silva, C. F. (2016). Executive Functioning in Criminal Behavior: Differentiating between Types of Crime and Exploring the Relation between Shifting, Inhibition, and Anger. *International Journal of Forensic Mental Health*, *15*(3), 235–246. https://doi.org/10.1080/14999013.2016.1158755

Shong, T. S., Abu Bakar, S. H., & Islam, M. R. (2019). Poverty and delinquency: A qualitative study on selected juvenile offenders in Malaysia. *International Social Work*, *62*(2), 965–979. https://doi.org/10.1177/0020872818756172

Singh, A., & Kiran, U. V. (2014). Effect of single parent family on child delinquency. *International Journal of Science and Research (IJSR)*, *3*(9), 866–868.

Snow, P. C., & Powell, M. B. (2011). Oral language competence in incarcerated young offenders: Links with offending severity. *International Journal of Speech-Language Pathology*, *13*(6), 480–489. https://doi.org/10.3109/17549507.2011.578661

Steinmayr, R., Ziegler, M., & Träuble, B. (2010). Do intelligence and sustained attention interact in predicting academic achievement? *Learning and Individual Differences*, *20*(1), 14–18. https://doi.org/10.1016/j.lindif.2009.10.009

Stevens, F. L., Hurley, R. A., & Taber, K. H. (2011). Anterior cingulate cortex: Unique role in cognition and emotion. *Journal of Neuropsychiatry and Clinical Neurosciences*, *23*(2), 121–125. https://doi.org/10.1176/jnp.23.2.jnp121

Sukyirun, P. (2016). Biosocial Interaction and Juvenile Delinquency Behaviors of Thai Juvenile Delinquents. *International Journal of Criminal Justice Sciences*, *11*(2), 100.

Syngelaki, E. M., Moore, S. C., Savage, J. C., Fairchild, G., & van Goozen, S. H. M. (2009). Executive functioning and risky decision making in young male offenders. *Criminal Justice and Behavior*, *36*(11), 1213–1227. https://doi.org/10.1177/0093854809343095

Tan, K., Brown, A., & Leibowitz, G. S. (2018). School, Social-Communicative, and Academic Challenges Among Delinquents and Juvenile Sexual Offenders. *Child and Adolescent Social Work Journal*, *35*(6), 577–585. https://doi.org/10.1007/s10560-0180549-1

Thornberry, T. P., Giordano, P. C., Uggen, C., Matsuda, M., Ann, S., Bulten, E., Donker, A. G., & Farrington, D. (2013). Series: Study Group on the Transitions between Juvenile Delinquency and Adult Crime. *Department of Justice*, 1–31. https://ncjrs.gov/pdffiles1/nij/grants/242931.pdf%5Cnhttps://ncjrs.gov/pdffiles1/nij/grants/242935.pdf

Tung, S., & Chhabra, N. (2011). A comparative study on the neuropsychological status of delinquent and non-delinquent boys. *International Journal of Culture and Mental Health*, *4*(2), 121–127. https://doi.org/10.1080/17542863.2010.530772

Vahl, P., van Damme, L., Doreleijers, T., Vermeiren, R., & Colins, O. (2016). The unique relation of childhood emotional maltreatment with mental health problems among detained male and female adolescents. *Child Abuse and Neglect*, *62*, 142–150. https://doi.org/10.1016/j.chiabu.2016.10.008

Van Hout, M. C., & Mhlanga-Gunda, R. (2019). Prison health situation and health rights of young people incarcerated in sub-Saharan African prisons and detention centres: A scoping review of extant literature. *BMC International Health and Human Rights*, *19*(1), 1–16. https://doi.org/10.1186/s12914-019-0200-z

Van Nieuwenhuijzen, M., Van Rest, M. M., Embregts, P. J. C. M., Vriens, A., Oostermeijer, S., Van Bokhoven, I., & Matthys, W. (2017). Executive functions and social information processing in adolescents with severe behavior problems. *Child Neuropsychology*, *23*(2), 228–241. https://doi.org/10.1080/09297049.2015.1108396

Wallinius, M., Nordholm, J., Wagnström, F., & Billstedt, E. (2019). Cognitive functioning and aggressive antisocial behaviors in young violent offenders. *Psychiatry Research*, *272*(June 2018), 572–580. https://doi.org/10.1016/j.psychres.2018.12.140

Wrigley-Asante, C., Owusu, G., & Oteng-Ababio, M. (2016). Poverty and Crime: Uncovering the hidden face of sexual crimes in urban low-income communities. *Ghana Journal of Geography*, *8*(1), 32–50.

Yoder, J., Grady, M. D., & Precht, M. (2019). Relationships between Early Life Victimization, Antisocial Traits, and Sexual Violence: Executive Functioning as a Mediator. *Journal of Child Sexual Abuse*, *28*(6), 667–689. https://doi.org/10.1080/10538712.2019.1588819

Yorke, E., Boima, V., Dey, I. D., Ganu, V., Nkornu, N., Acquaye, K. S., & Mate-Kole, C. C. (2020). Comparison of neurocognitive changes among newly diagnosed tuberculosis patients with and without dysglycaemia. *BMC Psychiatry*, *20*(1), 1–7. https://doi.org/10.1186/s12888-020-02570-8

Zou, Z., Meng, H., Ma, Z., Deng, W., Du, L., Wang, H., Chen, P., & Hu, H. (2013). Executive functioning deficits and childhood trauma in juvenile violent offenders in China. *Psychiatry Research*, *207*(3), 218–224. https://doi.org/10.1016/j.psychres.2012.09.013

## APPENDIX 1

UNIVERSITY OF GHANA
DEPARTMENT OF PSYCHOLOGY
SCHOOL OF SOCIAL SCIENCES

PSYC 2/33/03

Ref. No.....

July 3, 2019

The Administrator
Ethics Committee for Humanities (ECH)
Office of Research Innovation and Development
University of Ghana
Legon

Dear Sir/ Madam,

**LETTER OF INTRODUCTION**
**MISS SARAH MAAME AMA TURKSON - ID NO: 10371638**

The above-named student is a Clinical Psychology student in the University of Ghana.

As part of the requirement, Miss Sarah Maame Ama Turkson has to write and submit an original thesis. The title of her thesis is **"The Neuropsychological and Psychosocial Correlates of Juvenile Offenders; comparing Incarcerated Delinquents and a Matched Control"**.

She is planning to conduct her study at the senior correctional center in Accra and a public school in the vicinity.

She is applying to your board for institutional approval/clearance to enable her carry on with her research work. She has received approval from our department.

Yours faithfully,

Prof. Joseph Osafo
**(Head of Department)**

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Protocol number

**Ethics Committee for Humanities (ECH)**

GUARDIAN /PARENTAL PROTOCOL CONSENT FORM

Section A- BACKGROUND INFORMATION

| | |
|---|---|
| Title of Study: | The Neuropsychological and Psychosocial Correlates of Juvenile Offending: Comparing Incarcerated Delinquents and a Matched Control Group. |
| Principal Investigator: | Sarah M.A Turkson |
| Certified Protocol Number | ECH 021/19-20 |

Section B– CONSENT TO PARTICIPATE IN RESEARCH

**General Information about Research**

The purpose of the study is to investigate the neuropsychological functioning and psychosocial correlates of incarcerated juvenile offenders and a matched control group in Accra. Data collection will take approximately four months to complete. Participants must give informed consent or assent to proceed with the study. Trained researchers will administer a neuropsychological battery and survey questionnaires to juveniles residing in the Senior Correctional Centre and adolescents in a selected public high school. Instructions for each measure will be translated into local language(s) where necessary.

**Benefits/Risks of the study**

There are no risks associated with participation in this study. However, in event that there may be some form of unexpected psychological distress associated with participation in the study, licensed clinical psychologists will be available to attend to participants. In addition, each participant will receive a set of stationery and books. Each session will last for 3 hours; hence, there will be scheduled breaks in-between sessions to reduce fatigue. Should participants become anxious during sessions, the researcher will discontinue and reschedule assessment.

Participants may not directly benefit from the research. We expect that findings from this research will influence policy provision of interventions when adolescents are placed in corrective detention facilities.

**Confidentiality**

The researcher will identify participants with numbers to ensure anonymity. Participants will be tested individually. The search team, which includes supervisors, research assistants and the Neuropsychological and Psychosocial Correlates of Juvenile Offending.

principal investigator will have direct access to the research records at any particular time; thus, by signing a written consent form, participants are authorizing such access.

**Compensation**

Participants will receive a set of reading books and stationery at the end of data collection. There are no conditions for receiving these items. The reading materials will be distributed at the end of the study to participants at the Senior Correctional Centre and a public school in the vicinity.

**Withdrawal from Study**

Participation is voluntary and participants may withdraw at any time without penalty. More specifically, participants will not be adversely affected if they decline to participate or later stops participating. Participants and legal guardians will be informed as soon as possible, if relevant information to the participant's willingness to continue participation or withdraw becomes available. Should the participants miss three consecutive sessions, their participation in the study will be terminated.

**Contact for Additional Information**

For more information or questions about the research, do not hesitate to contact any of the following. Dr. Anum, University of Ghana, Psychology department, Email: AAnum@ug.edu.gh Tel: 0249107770, Dr. Amankwah-Poku, University of Ghana, Psychology Department. Email: mamankwah-poku@ug.edu.gh, 0277545995 and Sarah Turkson, University of Ghana, Psychology department, email: sturkson41@gmail.com Tel: 0208815456.

If you have any questions about your rights as a research participant in this study, you may contact the Administrator of the Ethics Committee for Humanities, ISSER, University of Ghana at ech@ug.edu.gh or 00233- 303-933-866.

Section C- PARTICIPANT AGREEMENT

**"I have read or have had someone read all of the above, asked questions, received answers regarding participation in this study, and am willing to give consent for me, my child/ward to participate in this study. I will not have waived any of my rights by signing this consent form. Upon signing this consent form, I will receive a copy for my personal records."**

_____

Name of Participants

_____ _____

Signature or mark of participants Date

**If participants cannot read and or understand the form themselves, a witness must sign here:**

I was present while the benefits, risks and procedures were read to the volunteer. All questions were answered and the volunteer has agreed to take part in the research.

The Neuropsychological and Psychosocial Correlates of Juvenile Offending.

_____

Name of witness

_____ _____

Signature of witness /Mark Date

I certify that the nature and purpose, the potential benefits, and possible risks associated with participating in this research have been explained to the above individual.

_____

Name of Person who Obtained Consent

_____ _____

Signature of Person Who Obtained Consent Date

**APPENDIX 3**

UNIVERSITY OF GHANA
ETHICS COMMITTEE FOR THE HUMANITIES (ECH)

Ethics Committee for Humanities
12 NOV 2020
Valid Until
(University of Ghana)

Ref. No.:.....

Sarah Turkson
Department of Psychology
University of Ghana
Legon

ETHICAL CLEARANCE
(ECH 021/ 19-20)

November 12th, 2019

On October 16th, 2019 the University of Ghana – Ethics Committee for the Humanities (ECH) at a full committee meeting reviewed and approved your protocol as follows:

TITLE OF PROTOCOL: **THE NEUROPSYCHOLOGICAL AND PSYCHOLOGY CORRELATES OF JUVENILE OFFENDERS; COMPARING INCARCERATED DELINQUENTS AND A MATCHED CONTROL.**

STUDENT INVESTIGATOR: **SARAH TURKSON**

Please note that the final review report must be submitted to the Committee at the completion of the study. Your research records may be audited at any time during or after the implementation.

Any modification of this research project must be submitted to ECH for review and approval prior to implementation.

Please report all serious adverse events related to this study to ECH within seven (7) days verbally and in writing within fourteen (14) days.

This certificate is valid till 12th November 2020. You are to submit annual reports for continuing review.

Please accept my congratulations.

Yours Sincerely,

**Professor C. Charles Mate-Kole.**
**ECH Chair**

Cc: Dr. Anum, Department of Psychology, UG.
Dr. Amankwah Poku, Department of Psychology, UG.

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