Chronic Offending in a Population of Adults Diagnosed with ADHD and CD as Children

by

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A dissertation submitted to the Graduate Faculty in Criminal Justice in partial fulfillment of the requirements for the degree of Doctor of Philosophy, The City University of New York

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Abstract

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By

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To understand, predict –and perhaps prevent-- serious, chronic criminal offending in adulthood, research needs to focus on the pre-adolescent behavioral patterns that put children at risk for criminal behavior. The goal of this study is to determine whether there are *childhood* behavioral, cognitive, and intra-familial factors that distinguish chronic criminal adult offenders within a population of men who displayed both Attention Deficit Hyperactivity Disorder and Conduct Problems as children. Research shows that children with these co-morbid problems seem to be at an elevated risk for future delinquency and crime, and it is for this reason that the comorbid population was chosen for examination. Childhood behavior disorders alone do not predict which individuals will become *repeat* offenders, however; and this study aims to determine which *additional* childhood factors, within such a population, lead to persistent criminality.

Data on this cohort were collected contemporaneously when the children were between six and twelve years of age. Members of the cohort who became serious, chronic adult offenders were compared, regarding their childhood data, with other members of the cohort to determine if discriminating childhood variables were identifiable. Results indicated that chronic criminality was correlated with elevated hyperactivity and antisocial behavior. There was also a slight negative relationship between verbal IQ and chronic criminal activity in one of the two cohorts. Intensive future study in this area is important if we are to understand why a small portion of the criminal population is consistently committing the majority of criminal acts. Financial resources can be better allocated if criminological research can identify a group of high-risk children whom, without intervention, are significantly at risk to become recidivists.

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I. Statement of the Problem

Criminal justice research indicates that a small portion of the offender population commits a disproportionate amount of crime in this country (Wolfgang, Figlio, Selin, 1972; Tracy, Wolfgang, Figlio, 1985; Farrington, 2000). Therefore, it should be one of the primary goals of criminological research to identify this specific group of offenders while they still are would-be offenders, and direct prevention efforts towards these potential recidivists. Identifying potential recidivistic offenders as early as possible is essential to this process. Recent research indicates that comorbid Attention Deficit/Hyperactivity Disorder (ADHD) and Conduct Problems (CP) are linked to chronic offending (Farrington, Loeber, Van Kammen, 1990; Lynam, 1996). The purpose of this research is to study selected behavioral, cognitive, and intra-familial factors amongst a group of boys exhibiting ADHD and CP to determine how these factors relate to chronic offending.

Criminological theory indicates that children with deficient self-control are at an elevated risk-level for committing crime (Wilson and Hernstein, 1985). Impulsive behavior, or "disinhibition," is one of the key components of an ADHD diagnosis, and when combined with aggression and early antisocial behavior, the risk of criminal activity is further heightened (Satterfield and Schell, 1997). Due to the increased rate of criminal involvement associated with comorbid ADHD and CP (hereafter referred to as comorbidity), a population displaying traits of both childhood problems was selected to be the focus of this study.

Alone, the co-occurrence of ADHD and CP is not a necessary or sufficient criterion to predict persistent future criminal behavior (Farrington, Loeber, Van Kammen, 1990; Satterfield and Schell, 1997). Therefore, it is essential to also examine a constellation of biosocial variables hypothesized to be relevant precursors to chronic criminality. This research design attempts to identify which childhood behavioral, cognitive, and intra-familial factors -- when compounded with ADHD and CP comorbidity -- are related to chronic offending in adulthood. For example, as will be shown in **Section III**, various early developmental factors, especially physical fighting and depressed verbal abilities, have been linked to criminal behavior. But it has yet to be determined

precisely which childhood behaviors are most closely linked to chronic, serious offending in adulthood.

As Blumstein et. al. point out, on average, active offenders are committing approximately five offenses annually and "those few persistent offenders who continue to be active into their thirties, display the lowest termination rates and the longest residual careers" (1986: 5). Thus, research is needed to study the developmental trajectories of participants who have had time to reach the apex of their criminal careers. This research project sought to be a step in that direction.

II. Overview of Attention Deficit and Disruptive Behavior Disorders

A. The Evolution of ADHD as a Disorder

The diagnostic nomenclature of ADHD has changed tremendously, particularly over the last two decades, as researchers have learned more about its symptomatology and diagnostic features. **Table 1**, displayed below, was compiled from a variety of sources and is included only to visually present the historical development of the nomenclature of the disorder. Despite the increased prevalence of the ADHD diagnosis in the last ten years, the collection of behavior patterns now called ADHD has been recognized for almost a century. As diagnostic techniques evolved and became more refined, new terms were generated, affecting not only how the symptoms were treated, but how the disorder was perceived as well.

Table 1. Nomenclature and Nosology of ADHD

1902	*Term:* major, chronic "defect in moral control" (Still, 1902). These children were aggressive, obstinate, unobservant, and overactive.
1917-1918	*Term:* "Post Encephalitic Behavior Disorder" used in the United States.
1934	*Term*: "Organic Drivenness" caused by trauma to the brain.
1930s, 40s, 50s	*Term:* "Minimal Brain Damage / Minimal Brain Dysfunction" (MBD) typifying organic injury caused by environmental factors.
1937	Amphetamines (stimulant medication) are first used to treat children.
1938	*Term:* "Restlessness Syndrome" implying brain disease coupled with behavioral pathology (Barkley, 1990).
1957, 1960	*Term:* "Hyperactivity" (Laufer and Denhoff, 1957; Chess, 1940).
Late 1950s, 60s 1970s	*Term:* "Hyperkinetic Syndrome," emerged as subtype of MBD (DSM-II, 1968). Behavioral interventions are researched, although medication is still the primary strategy (Barkley, 1990).
1972	Inattention and impulsivity are thought to cause more severe difficulties than hyperactivity (Douglas, 1972).
1980s	*Term*: Attention-Deficit Disorder with and without Hyperactivity identified as ADD/+H or ADD/-H (DSM-III, 1980). Research on the biology and etiology of ADHD.
1987	*Term:* Undifferentiated-ADD is added and name changes to Attention Deficit Hyperactivity Disorder marking the return of prominence of hyperactivity (DSM-III-R, 1987).
1994	DSM-IV recognized three subtypes of ADHD: predominately inattentive, hyperactive-impulsive, or combined type.

The Diagnostic and Statistical Manual of Mental Disorders, 4th Edition (1994) — "DSM-IV"— lists ADHD as an Axis I clinical disorder because it is usually first identified and diagnosed in childhood. Some of the behavioral characteristics necessary for the diagnosis must be present before the child reaches his/her seventh birthday, yet frequently s/he will display most symptoms before this age (DSM-IV, 1994). ADHD is comprised of three subtypes: (1) Predominately Inattentive; (2) Predominately Hyperactive-Impulsive; and (3) Combined. **Table 2**, below, is a summary of the behavioral criteria necessary for each diagnosis. The presence of at least six symptoms from the first column, persisting for at least six months will yield a Predominately Inattentive type diagnosis (also known as ADD). The Hyperactive-Impulsive type also requires six symptoms, this time from the second column. Finally, children with the Combined type meet the criteria listed in both columns.

Table 2. Behaviors Observed in Attention Deficit/Hyperactivity Disorder (DSM-IV, 1994)

Inattention
- Makes careless mistakes in schoolwork
- Has difficulty sustaining attention to details
- Seems not to listen when spoken to
- Does not follow through on instructions
- Has difficulty organizing tasks
- Dislikes tasks that involve sustained mental effort
- Often looses necessary things
- Often distracted by extraneous stimuli
- Often forgetful in daily activities

Hyperactivity
- Fidgets or squirms
- Often leaves seat in classroom
- Often runs about inappropriately
- Difficulty playing quietly
- Often "on the go"
- Talks excessively

Impulsivity
- Often blurts out answers
- Often has difficulty waiting turn
- Often interrupts intrudes on others

The Combined type is the most common, occurring more often than the Hyperactive-Impulsive or the Predominately Inattentive types (Lahey et. al., 1994). Children given a Combined type diagnosis are generally burdened with all three categories of symptoms (although they can still meet the combined criteria and display no impulsive symptoms) and have the most oppressive and ubiquitous difficulties. The distinction between subtypes is of paramount importance when examining criminal behavior in adults who were diagnosed with ADHD as children. As will be discussed in greater detail in subsequent sections, it is the hyperactive and impulsive symptoms that are the hypothetical precursors to future crime, not inattention.

With ADHD being present in three to five percent of school age children in America (DSM-IV, 1994: 82), it is rapidly becoming one of the most prevalent childhood psychiatric diagnoses. Current data indicate that approximately thirty-five percent of all children referred to mental health clinics are referred for ADHD (Swanson et. al., 1998). DSM-IV Field trials report that the disorder is more prevalent in males than in females (4:1 in the general population and approximately 9:1 among clinical samples) (DSM-IV, 1994: 82).

It is also estimated that thirty to fifty percent of adults who were diagnosed with ADHD as children still meet the criteria for the syndrome (Swanson et. al., 1998; Weiss, Hechtman, 1993), indicating that at least for some, symptomatology continues into adulthood, although the disorder's presentation can be somewhat altered by learned behavioral coping strategies. As is true of many disorders, co-morbidity (meeting the diagnostic criteria for more than one disorder) aggravates the prognosis. For instance, the chance that an individual will display ADHD symptoms as an adult increases considerably if the individual also exhibited co-morbid symptoms of Oppositional Defiant Disorder or Conduct Disorder when they were children (Shaffer, 1994).

B. Etiology of ADHD: The Biological Perspective

New developments in neuroscience have allowed researchers to more adequately explore ADHD's biological underpinnings. The most recent models suggest that three sections of the brain are disrupted in people with the disorder: prefrontal cortex, two regions within the basal ganglia (the caudate nucleus and the globus pallidus) and the cerebellum. All three of these regions of the brain have been shown to be smaller in children with ADHD (cortex and basal ganglia—Castellanos and Rapoport, 1996; cerebellum—Castellanos, 1998). The right prefrontal cortex is central to one's ability to resist distractions and develop an awareness of self and time (Barkley, 1998). The caudate nucleus and the globus pallidus allow for inhibition of an automatic response to provide time for deliberation and forethought (ibid). The role of the cerebellum is somewhat unclear but it is being implicated in the regulation of motivation.

Although the exact etiology of ADHD is still unknown, researchers report that heredity could be a factor in some cases of ADHD. Results indicate that 50 percent of ADHD children have biological parents who were similarly diagnosed (Barkley, 1998). Twin studies also lend

credence to the hypothesis that ADHD has a genetic component, reporting that concordance between identical twins is between 0.75 and 0.91, which is substantially greater than that reported between non-twin siblings (Levy et. al., 1997) as well as fraternal twins. Another study by Gillis and her associates shows that if one identical twin has ADHD, there is between 55 and 92 percent likelihood that the other twin will develop the condition (1992).

Furthermore, recent studies, using diverse methodologies, indicate that a ADHD is a polygenic disorder, meaning that more than one gene may be responsible for the inheritance of ADHD (Favaone and Biederman, 1994). Genetic studies focus on the genes responsible for producing and absorbing chemicals in the brain called neurotransmitters, whose function it is to convey messages from one nerve cell (neuron) to another. Most studies focus on dopamine as the primary neurotransmitter responsible for the dysfunction (Swanson et. al., 1998; Smalley et. al. 1998). The problem created by dopaminergic dysfunction is hypothesized to be two-fold. First, when dopamine is released from the neuron, it must cross the synapse and join with a dopamine receptor on the surface of the next neuron to convey the message. Mutations in a dopamine receptor can make it less sensitive, causing less dopamine to adhere to the receptor site, resulting in an interrupted message. A large number of dopamine receptor sites are concentrated in the prefrontal cortex and the basal ganglia in the brain (Castellanos et. al., 1996), which helps to explain why these sites are implicated in the dysfunction.

The second problem centers on the dopamine transporter which adheres itself to the neuron at the synapse. Dopamine transporters re-absorb extra dopamine so that it can be reused after it has been released into the synapse and not attached itself to the dopamine receptor on the next neuron. In children with ADHD, the dopamine transporters are hypothesized to be on "over-drive," causing them to absorb the dopamine too quickly, before it has a chance to attach to a dopamine receptor on the adjacent neuron and convey its message. Both dopamine receptor and transporter dysfunction result in a communication failure between neurons.

The mutations in both the dopamine transporter gene (DAT1) and the dopamine receptor gene (D4) are more common among children with ADHD than other children (Cook et. al., 1995; LaHoste et. al., 1996). Neurotransmitter dysfunction is often controlled using stimulant

medication including Methylphenidate (Ritalin), and Dextroamphetamine (D-amphetamine). These stimulants inhibit the dopamine transporter, causing more dopamine to be present at the synapse, which allows more time for the dopamine to attach itself to the receptor and convey its message.

C. Etiology of ADHD: The Psychological Theories

Most psychological theories now acknowledge that environmental factors are only exacerbating a biological predisposition, and are not in and of themselves the sole cause of ADHD. The aim of these theories is to complete the etiological picture by filling in what cannot be explained biologically. A mother's care of her newborn is one of the causal factors that has been implicated and explored. In an article by Jacobvitz and Sroufe (1987) numerous measures were used to test infants at birth, at two years, and again at three and one-half years of age to see if they could predict hyperactivity in kindergarten. Maternal interference (mother disrupting the baby's normal activities), over-stimulating care (stimulating the child instead of soothing him), and the child's own distractibility were rated and found to be significant predictors.

Another study by Anderson et. al. (1994) investigates maternal psychopathology, negative maternal behaviors, and child negativity towards the mother in older ADHD boys (6 to 12 years) to determine if they are accurate predictors of non-compliance and stealing. Results indicate that a mother's negative behavior is a statistically significant predictor of both covert theft and overt defiance in her child, even once the child's negativity was controlled for. Studies such as this one are reminders that even if a genetic cause is responsible for the transmission of ADHD, an unhealthy caregiver relationship can worsen a child's symptoms. In some cases, the parents themselves are genetically predisposed towards ADHD, and may tend to engage in ADHD behaviors that interrupt the consistency of their parenting style. When caregivers are unable to form secure attachments to their children, either because of their own inadequate parenting style or because the child is "fussy" or distracted, tension and stress may develop within the family which can exacerbate the child's ADHD symptoms. This is not due to a caregiver's independent decision to dislike their child; parents may be frustrated by the child's behavior thereby causing the care they deliver to be deficient and sometimes even harmful.

In recent years, researchers have presented many novel approaches to viewing ADHD. One such study by Jensen et. al. (1997) uses an evolutionary model to explain ADHD as a "disorder of adaptation." Drawing from Darwin's principles of Natural Selection, the authors hypothesize that ADHD would not be maintained if it did not have certain advantages. Hyperactivity, inattention, and impulsivity could be perceived as adaptive a few millennia ago. For example, increased impulsivity leads to faster response times, which keeps an individual "on his toes," helping him to dodge a dangerous predator without hesitation. However, a modern technologically-complex industrial society values "problem-solving" traits such as restraint and control, more than the "response-ready" traits apparent in the ADHD child. Although their inattention may be selective, allowing them to attend well in certain areas (e.g., sporting activities or video games), these children have a difficult time in school because it requires conforming to a routine and concentrating on a multitude of subjects. Large classroom sizes and inadequate teacher training can also play a part in stigmatizing the ADHD child as maladaptive.

D. Disruptive Behavior Disorders

As the DSM-IV notes, frequently children who display symptoms of a conduct disorder during early adolescence were oppositional as children, and were described as overactive as infants. In other words, among children who display Conduct Disorder symptoms, in many cases there was a history of both defiant and hyperactive behaviors throughout the child's development. On the other hand, there is a significant portion of ADHD children who never progress to Oppositional-Defiant Disorder or Conduct Disorder. Therefore, although children with ADHD are five times more likely than children without ADHD to eventually display hostile and defiant behaviors resulting in a diagnosis of either ODD or CD (Loeber et. al., 1995), the majority of ADHD children do not develop either of these disorders. It is predominately children with the combined type of ADHD that are at greater risk for developing a comorbid disorder than children with the inattentive type (Lahey, Applegate, McBurnett, et. al., 1994; MacDonald and Achenbach, 1996).

The category of Disruptive Behavior Disorders listed in the DSM-IV includes Oppositional-Defiant Disorder (ODD) and Conduct Disorder (CD), both of which will be briefly

described below. ODD is the less severe of the two disorders, primarily because most of the problem behavior is verbal, whereas the CD symptoms often entail more disruptive and violent, if not criminal, physical manifestations. ODD is less severe and is frequently exhibited and diagnosed at a younger age than CD (DSM-IV, 1994). To receive an ODD diagnosis, children must display at least four of the following behaviors: frequently loosing one's temper, arguing with adults, refusing to comply with rules, deliberately annoying others, blaming others for own mistakes, and being angry, spiteful, and vindictive more often than other children of the same age (ibid.).

ODD is more common in households with inconsistent discipline and unstable or erratic parenting and, as such, children with ODD are frequently at odds with their parents, teachers, and other authority figures (DSM-IV, 1994). ODD is frequently an intermediate diagnosis, and is only given if the criteria for CD are not met. If a child meets the criteria for CD, the lesser ODD diagnosis is not given. In many cases ODD is a developmental antecedent to CD, causing ODD children to be more at risk for developing CD than the average child (ibid.).

The diagnostic criteria for CD are divided into four major categories, which are presented below in the first column of **Table 3.**

Table 3. Conduct Disorder Criteria (DSM-IV)

Category	Behavior
Aggression to people and animals	• Bullies, threatens, or intimidates • Initiates physical fights • Used a weapon • Physically cruel to people & animals • Stolen while confronting a victim • Forced someone into sexual activity
Destruction of property	• Fire setting • Deliberately destroys property
Deceitfulness or theft	• Broken into house, building, or car • Lies • Steals without confronting victim
Serious violation of rules	• Stays out all night before age 13 • Runs away from home • Truant from school

Conduct Disorder symptoms can manifest either in childhood, or develop somewhat later in adolescence. The disorder is divided into subtypes based on the age the child first exhibited symptoms. Although there are two subtypes of CD, the childhood-onset type is the most relevant to the current study. This type of CD is defined by the development of some symptoms before the age of 10. Research shows that in many cases ADHD is a precursor to the *childhood*-onset of CD, which has a worse prognosis than the adolescent-onset type (Loeber et. al., 1995). Children with the childhood-onset type are usually male and are more likely to be physically aggressive (Lahey et. al., 1998), using drugs or alcohol (Windle, 1992), and develop Antisocial Personality Disorder (Robins, Tipp, Pryzbeck, 1991) than those with a later onset of symptoms or those that did not previously have ADHD or ODD.

The co-occurrence of two disorders can exacerbate the severity of each disorder's symptoms. For example, a child with both ADHD and CD will tend to exhibit more severe hyperactivity or impulsivity than a child with ADHD only (Kuhne, Schachar, Tannock, 1997; Waschbusch, 2002). Research shows that ODD and CD alter the correlates of ADHD, producing a greater number of ADHD symptoms and more severe ADHD symptoms in comorbid children (ibid.; Barkley, 1990). Prevalence rates indicate that ODD co-occurs in approximately 35% of children with ADHD (Bird et. al., 1993), and CD is comorbid in 30% to 50% of ADHD children (Biederman et. al., 1991). Comorbid CD can also be viewed, not as a separate and distinct condition, but as a manifestation of ADHD that has been exacerbated by environmental influences (i.e., poor parenting). Neither a neurobiological nor a genetic basis for CD has been identified, separate and apart from the effect of ADHD. Therefore, CD could be perceived as a form of ADHD, characterized by hyperactivity and impulsivity, which has been intensified by the child's surroundings during their development.

III. Review of the Literature Linking ADHD and CD to Criminal Behavior

Recently, many authors have contributed to a body of literature attempting to provide a theoretical framework for explaining (or negating) a link between ADHD and crime. Nagin and Tremblay (1999) present a comprehensive model detailing the relationship between hyperactivity, conduct problems, and criminality. These authors divide the existing empirical research into three broad categories in an effort to capture most relevant findings: Single Pathway Model, Different Pathways Model, and Cumulative Effects Model. I have used this typology here and expanded it to include a fourth category, the Synergistic Model.

A. The Single Pathway Model

Research that supports the Single Pathway Model identifies inadequate self-control as the key component of ADHD that puts children at risk for all types of criminal behavior. More specifically, in this view, the child's conduct problems are not a *causal* factor; it is the ADHD that is causing later broad-based delinquency. Although this model is discussed in the context of ADHD, there is another side to the same coin. Some authors, although they agree with the concept of a single pathway to criminal behavior, argue that conduct problems are the precursor to future criminality, and that ADHD alone is not a risk factor (Cadoret and Stewart, 1991; Satterfield and Schell, 1997; Macdonald and Achenbach, 1996). Studies supporting both sides of this theoretical dichotomy will be presented here, before advancing to a discussion of the Different Pathways Model.

Research by Taylor et. al. (1996) supports the theory that ADHD is a risk factor for future criminal behavior. Their results indicate that a childhood diagnosis of ADHD predicts future violence and covert antisocial behavior, even in the absence of conduct problems. Those participants in their study who were diagnosed with only ADHD when they were children had fewer peer relationships and more academic problems at seventeen years than the group with only conduct problems. The ADHD children also had a lower IQ and displayed more aggression than the CP only group at follow up. These data support the hypothesis that children with ADHD are prone to developing a pattern of long-term aggressive behavior coupled with academic deficits, which has been identified as a risk factor for future criminality.

These results are somewhat anomalous however, and could be due to differences in the criteria used by the DSM-IV and the International Classification of Diseases (ICD-10), the later of which was used in the Taylor et. al. study. Instead of ADHD, the ICD-10 uses the term Hyperkinetic Disorder and requires slightly different criteria for a diagnosis. The diagnosis is also obtained using different questionnaires and testing measures. These two differences could help to explain why these results which indicate that ADHD is predictive of future delinquency, are not being consistently replicated.

Contrary to the Taylor et. al. (1996) study, the majority of the Single Pathway research indicates that conduct problems, not ADHD, are correlated with future criminality. For example, Satterfield and Schell (1997) found that only the ADHD boys in the cohort who also had comorbid conduct problems were likely to have either a juvenile or an adult arrest record. A post-hoc examination of the children who had ADHD but no conduct problems showed that they did not have an elevated risk for being arrested or incarcerated, indicating that hyperactivity alone was not a risk factor.

Weiss et.al. (1979), Hechtman et.al. (1984), and Mannuzza et al. (1993) also reported no significant differences between two cohorts (ADHD vs. Controls) of young adults with regards to the number or gravity of their criminal offenses during the years preceding the study. All three of these studies made attempts to screen out children with conduct problems, in an effort to identify the effects of ADHD alone. Their results indicate that ADHD alone is *not* linked to future criminality. These studies did point out, however, that in comparison to the controls, the ADHD children had an elevated risk for developing Antisocial Personality Disorder, even if their levels of criminal behavior were not significantly elevated.

To synthesize the data in this area, it is fair to say that ADHD children with conduct problems are at risk for future delinquent, antisocial, and criminal behavior. Unfortunately, many early research methodologies failed to distinguish between ADHD and conduct problems which confounded their results, making it difficult to measure each disorder's effect on future criminal

behavior.[1] Recently, however, a consensus in the literature has formed indicating that conduct problems, not ADHD, elevate the risk of future criminality. Although ADHD alone is not a risk factor, comorbid ADHD may exacerbate the conduct problems and increase a child's risk of delinquency and crime. Regardless, it is clear that more attention needs to be paid to children with this comorbid condition as they mature.

B. The Different Pathways Model

Findings from Nagin and Tremblay's recent longitudinal study (1999) support the contention that aggression, opposition, and hyperactivity are distinct clusters of symptoms and as such are predictive of particular types of delinquency. For instance, their results indicate that boys who were rated as hyperactive in kindergarten were *less* likely to become delinquent as juveniles, when compared to boys who displayed high levels of physical aggression or opposition. This lends further support to the notion that ADHD alone is not as indicative of future criminal behavior as ODD or CD. Furthermore, the study found that chronic oppositional traits, displayed throughout the ten years of testing, more frequently led to covert delinquency (i.e., theft), while chronic physical aggression, with opposition and hyperactivity held constant, led to more serious overt delinquency (i.e., physical violence). Other authors have also cited the importance of physical fighting as a precursor in the development of CD (Loeber et. al., 1995), and as being related to levels of impulsivity (Halperin et. al., 1995). As such, it will be an important independent variable in the current study.

The Different Pathways Model (which might also be termed the Multiple Pathways Model) identifies specific early childhood behaviors to determine if they are associated with unique trajectories of delinquent behavior during development. Kuhne, Schachar, and Tannock (1997) examine a variety of behavioral characteristics to determine whether they are correlated with the presence of comorbid ADHD + CD, comorbid ADHD + ODD, or ADHD only. Children with either of the two comorbid conditions faired worse than the "pure" ADHD participants, although they

[1] Early studies grouped ADHD with the Disruptive Behavior Disorders, making it difficult to parse out the effects of ADHD alone. It is imperative that future studies keep ADHD diagnoses distinct from ODD and CD symptoms. As Nagin and Tremblay (1999) note, "the majority of developmental studies continue to confound physical aggression with verbal aggression, indirect aggression, opposition, hyperactivity, and other disruptive or troublesome behaviors" (p. 3). Non-specific methodologies lead to convoluted results, which blur the distinctions between the trajectories of these disorders.

each had distinct profiles. The comorbid CD children showed higher levels of aggression and a decreased self-esteem, whereas the comorbid ODD children were more socially withdrawn and ranked slightly higher in academic achievement. Although this study does not attempt to draw conclusions about how well these behaviors predict crime, it supports the hypothesis that both comorbid conditions present differently, with each group displaying unique attributes. To take this conclusion a step further, since the comorbid CD children have more aggressive tendencies, if they did become delinquent this behavior is likely to be reflected in the type of criminal activity they choose.

C. The Cumulative Effects Model

In general, the Cumulative Effects Model is additive in nature due to the assertion that the more behavioral difficulties a child has during childhood, the greater the likelihood that he will engage in some delinquent or criminal conduct as he matures. It ascribes to the fundamental belief that the more symptoms a child displays, regardless of whether they are ADHD, ODD, or CD symptoms, the greater their predilection for delinquency.

Farrington, Loeber, and Van Kammen (1990) referred to symptoms of ADHD as Hyperactive-Impulsive-Attention deficit problems or "HIA" and used a methodology which kept the effects of HIA and conduct problems separate. Their results support the premise that "HIA and conduct problems are differently related to early background factors and to later criminal outcomes" (Farrington, Loeber, Van Kammen, 1990: 77). For instance, HIA was found to be related to low IQ scores, criminogenic parents, and a large family size, whereas poor parenting, inadequate supervision, and low socio-economic status were indicative of conduct problems.[2] The data indicate that when HIA presents with co-morbid conduct problems it has an additive effect that is more detrimental than either disorder alone. This is supported by the fact that the comorbid children are more likely than the "pure" HIA or "pure" CP children to be arrested, convicted for both juvenile and adult offenses, and recidivate. However, Farrington et. al. did not

[2] This is in opposition to the findings of many other research teams, whose data indicate that IQ is independent of ADHD diagnosis (Pennington, Grossier, Welsh, 1993; Swanson et. al., 1998). The results from the Farrington et. al. study could be due to the fact that one group is typified by low IQ and the other low SES, and not by virtue of their diagnostic classification. For example, the boys in the high juvenile conviction group were more hyperactive and impulsive, but they were also overwhelmingly from low-income families. This finding would have been more valuable if participants in the two groups had similar SESs and IQs.

control for socio-economic differences amongst their different groups. It is the task of the current research design to identify a cluster of biosocial factors frequently affiliated with ADHD/CP comorbidity to determine which, if any, of these characteristics are specifically predictive of chronic offending.

Researchers rarely agree on the exact relationship between ADHD and CD. Are they just steps along the developmental pathway leading to delinquency? Or are each risk factors that magnify the intensity of the other? Or are they actually the same disorder predicting delinquency based on the level of symptom severity? Numerous studies do concur, however, that children with the comorbid condition are in jeopardy of turning towards a criminal lifestyle. In a retrospective analysis by Dalteg and Levander (1998), participants with the comorbid ADHD + CD condition were found to have committed twice as many crimes, committed a wider variety of crimes, and spent more days in prison during their lifetime than participants with "pure" CD. There was also a trend towards more violent crimes in the comorbid group, but it was not significant.

D. The Synergistic Model

The term "synergistic" typifies the theory supporting this model because, unlike the above models which argue that the effect of ADHD and CD on delinquency is additive (where ADHD produces "x" amount of delinquency and CD produces "y", and the amount of delinquency should be "x + y"), synergistic model indicates that somehow children with the comorbid condition are *more* delinquent than can be expected from the accumulation of each effect. To capture this phenomenon of the whole being greater than the sum of its parts, I have adopted the term "synergy." One such theorist is Donald Lynam (1996), who speculates that children with both ADHD and CD actually make up a subtype of CD. He labels a child in this subtype a "fledgling psychopath." Throughout their lifespan, he posits, these individuals are at the greatest risk for chronic offending due to a deficient "P-constraint" (psychopathic constraint) which "creates difficulty in incorporating feedback from the environment and using this information to modulate responses, while pursuing rewards" (Lynam, 1996: 224). In short, he theorizes that ADHD + CD individuals are in jeopardy of neglecting the risks associated with punishment during the

commission of a crime. The deficient "P-constraint" is not present in all children with ADHD, yet the children who exhibit *both* are much more likely to develop conduct problems, display antisocial behavior, and engage in criminal activities. Lynam speculates that this trend is due to the maturation process of the "P-constraint," which expresses itself differently at different life stages.

The concept of a deficit in constraint is similar to the central theory in Barkley's *ADHD and the Nature of Self-Control*. Barkley (1997) discusses the relationship between impulsivity, hyperactivity, and inattention, describing ADHD as a "developmental disorder of behavioral response inhibition," implying that ADHD children are not able to self-regulate their responses as well as other children. For the ADHD child, there is no delay between stimulus and response, and therefore no thought is given to maximizing the long-term outcome. In effect, the child will take the small immediate reward based on an automatic response, instead of delaying gratification in an effort to achieve the larger, long-term goal. A child's ability to self-regulate provides the delay required for a variety of brain functions to occur, including (1) decoding and processing stimuli for significance, (2) generating an appropriate emotional arousal level, (3) retrieving and analyzing associations with similar events, (4) formulating intentions to act and appropriate response strategies, and (5) directing and monitoring goal-related activity. These functions are hypothesized to be regulated by the right prefrontal region of the brain, which has been found to be smaller in children with ADHD. Barkley argues that the fundamental deficit is the child's inability to self-regulate, not his or her inability to pay attention. Inattention is a byproduct, which results because the child cannot inhibit his or her own automatic response and tune out distractions. Barkley concludes that inattention is a secondary deficit, and one that would show improvement if the primary deficit in behavioral inhibition could be rectified.

It seems logical that a lack of constraint, demonstrated by impulsivity, could magnify the effect of a Conduct Disorder, and thus increase the child's chance of becoming delinquent. However, theories that hypothesize that behavioral control is lacking in these children and that this is causally linked to crime have yet to be tested empirically.

All of the four models discussed above pertain to the link between ADHD, Disruptive Behavior Disorders and future criminality. They form a good starting point from which to understand the early precursors of crime. However, this study does not attempt to show a link between early childhood behaviors and crime in general. It focuses instead on a very specific type of criminal behavior: serious, chronic offending. Unfortunately, the literature in this area is much more sparse, with no over-arching models to neatly classify the correlations between childhood behavior and chronic adult criminal offending. Therefore, the Single Pathway Model, the Different Pathway Model, the Cumulative Effects Model, and the Synergistic Model will be referred to throughout this paper but only as reference points to then see how well chronicity can be predicted by the data.

IV. Previous Research Using the Satterfield Cohort

A. Cohort's Demographic Information

The childhood data to be analyzed in the current study has been described in numerous other articles by James Satterfield and his associates (Satterfield, J., Hoppe, C., & Schell, A. 1982; Satterfield, J., & Schell, A. 1997; Satterfield, J., & Schell, A. 1984; Satterfield, J., Schell, A., & Backs, R. 1987; Satterfield, J., Swanson, J., Schell, A., & Lee, F. 1994).[3] Therefore, only a brief description of the cohort itself and a summary of previous findings will be included here. Between 1970-72 the participants were six to twelve year old males[4] who were referred to a clinic in Encino, California for learning and/or behavioral problems. At that time the participants were screened for ADHD, ODD, and CD symptomatology using numerous examination methods including rating scales developed by Satterfield, Swanson, and Conners which are similar to the DSM-III criteria for ADD with hyperactivity.[5] The child, his parents, and his teachers were asked to respond to a variety of neuropsychological, psychoeducational, and neurophysiological tests and interviews capturing copious amounts of data on a wide variety of subjects.

The study was originally designed to evaluate various treatment modalities. For this reason, the boys were placed (not randomly assigned) into one of two treatment groups and administered a placebo and/or varying levels of psychostimulant medication and/or behavior modification. The two groups were the Drug Treated Group (DTO) and the Multimodality Treatment Group (MMT). To ensure parity, all of the participants were diagnosed prior to beginning treatment. Previous studies by Satterfield (1982) on this cohort have shown that delinquent outcome was unrelated to length or type of drug-treatment. Therefore, participants in the current study will be chosen from both the drug treated and multimodal treatment groups.

There is a question in the original testing packet about parental income levels, and the write-up will discuss any finding of difference between the two groups, if it is indeed significant.

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[3] Significant information about the differences in brain function (including electroencephalograms, and auditory event-related potentials) between the delinquent and non-delinquent ADHD participants in this cohort has also been published although it will not be discussed here (Satterfield, J. & Schell, A. 1984; Satterfield, J., Schell, A., & Backs, R. 1987).

[4] There are no female participants included in Satterfield's cohort.

[5] Although the DSM-III was not published until 1980, the authors were aware of the new criteria and were already using a portion of them in their diagnostic procedures. Many of these criteria are still used in the DSM-IV.

There is however, no way to control for the participant's *adult* SES, as I did not have access to this information.

Satterfield's cohort was last followed up when the participants were approximately 23 years old on average and ranged in age from 19 to 25 years. At that time the 89 ADHD children and the 87 controls were traced to quantify criminal justice system involvement. This was not the entire dataset however, which includes upwards of 400 participants, some with missing data. If the participant was missing data fields that were not pertinent to the current study, the participant was included in the analysis. At the time of data collection, the participants were in their mid- to late 30s (approximately 34 to 41 years old) and, based on crime trends, should have reached the apex in their criminal careers (Federal Bureau of Investigation, 1991).

B. Summary of Previous Findings

Previous studies of the Satterfield cohort generated a variety of important results. In a study published in 1982, the authors followed up the cohort during adolescence and found a significant trend towards the incarceration of the ADHD participants (25% vs. 1% of controls). The authors also noted a relationship between ADHD and serious offending (including robbery, burglary, grand theft, grand theft automobile, and assault with a deadly weapon). 58%, 36%, and 52% of the ADHD children in the lower, middle, and upper socioeconomic groups had been arrested at least once, as compared to the control group's percentages of 11%, 9%, 2% respectively. This is a higher percentage difference than has been reported previously. This could be associated with many factors including the large number of ADHD boys who also scored significantly higher than controls on lying, stealing, and aggression which are all symptoms of CD. As discussed in **Section III**, it is more likely that the comorbid conduct problems, not the ADHD alone, produced such a pronounced result. This study also reported an immense difference in the percentage of ADHD participants who had committed multiple, serious offenses again stratified by lower, middle, and upper SES: 45%, 25%, and 28% for the ADHD children compared to 6%, 0%, 0% for the controls.

In 1994 the cohort was again studied, this time analyzing childhood opposition and defiance to determine if they were correlated with felonious juvenile offending. Results showed

that ADHD boys who also displayed some ODD symptoms were at a greater risk (compared to the ADHD, non-ODD boys) for committing felonies in the future. Interestingly, the ADHD boys who did not show any ODD symptoms still had an elevated number of felony arrests when compared to the non-ADHD participants. This would indicate, contrary to most other research, even ADHD children *without* conduct problems are still in greater jeopardy than controls of becoming adult offenders (Satterfield, Swanson, Schell, & Lee, 1994).

Finally, the most recent follow-up by Satterfield and Schell (1997) demonstrates that hyperactive boys displaying conduct problems are more likely than controls to have a juvenile arrest record (46% vs. 11%) and are similarly 21 times more likely to be arrested as an adult. Furthermore, these boys are not only more likely to be arrested, but of those arrested they are much more likely than controls to be younger, commit violent rather than property crimes, and to have a history of multiple offenses. The younger the boy is at the time of his first arrest, the more likely it is that he will continue committing crime in adulthood, whereas the boys who commit their first offense after age fifteen are much more likely to desist as they age.

V. Current Methodology

A. The Research Question

The purpose of the current study is to investigate the prospective predictive power of certain supposed childhood risk factors for chronic offending in a population of male adults who have reached their peak age for criminal activity. All participants in this population were identified and diagnosed with ADHD and CP[6] in their youth, which has been shown to be associated with an increased risk of criminal activity (Babinski, Hartsough, & Lambert, 1999; Lynam, 1996; Satterfield, & Schell, 1997). The primary goal of this study was to determine whether specific early behavioral factors typified chronic recidivists within this population and distinguished them from non-chronic offenders and non-offenders.

The predictor variables used to forecast adult criminality include: hyperactivity, impulsivity, physical fighting, antisocial behaviors, fire starting, cruelty, stealing, thrill seeking, fearfulness, verbal IQ, and socio-economic status. Each of these eleven variables has been shown by previous research to be related to criminal activity in males (Farrington, Loeber, Van Kammen, 1990; Nagin and Treblay, 1999; Satterfield and Schell, 1997). The first nine of the predictor variables in the above list pertain to behaviors displayed by the participants during childhood. Since numerous questions were asked about each of these behaviors, the scores for each question were aggregated to yield a composite score based on the total points possible. Verbal IQ was taken from the participant's WISC-R test and the parents were asked to rank their family's socio economic class (SEC) as low, medium, or high based on their annual income.

B. Diagnostic Sources and Tools

- **Participant Questionnaires**

As mentioned previously, Dr. Satterfield and his staff collected a wide variety of neuropsychological, psychoeducational, and neurophysiological information. Since Dr. Satterfield has retired, he has consented to let the Child Development Center in Irvine, California and its associates utilize the cohort database to conduct subsequent follow-up research. At the time of

[6] Although some portion of the participants would meet the current DSM-IV definition of Conduct Disorder, it cannot be said that all the boys in the cohort would have. Therefore, the more general term (Conduct Problems) is used to describe a cluster of these childhood symptoms; however, when referring to the syndrome as a whole, the term CD is used.

the initial childhood data collection, the boys were referred to the clinic in Encino, California, and multiple diagnostic tools were used to gather information including the Satterfield Parent and Teacher Rating Scales. These scales were commonly used to diagnose children with ADHD and CP, and were completed by both parents and teachers. Since these rating scales are measured on a three point Likert scale, the scores will be used to determine not only the presence or absence of a symptom but also the severity of the symptom compared to other participants.

These variables were measured by data gathered from parents and teachers during the boy's childhood. Each of the questions asked of the respondents (excluding IQ and SEC scores) was based on a four-point Likert scale (scores ranged from zero to three) with the higher score indicating that the participant possessed more of the trait. Points from each of the questions were added up to yield a composite score for the variable. The individual questions are listed below:

Table 4. Data Variables and Sources

Individual Questions	Source
Hyperactivity (11 questions, 3 points each) ADHD Scale	
Restless, always on the move	Parent & Teacher
Fidgets, can't sit still	Parent & Teacher
Talks a lot, is noisy	Parent & Teacher
Has more energy than other children his age	Teacher
Gets wound up, overexcited on trips or treats	Parent
Gets wound up, overexcited around other children	Parent
Satterfield parent rating scaled score	Parent
Satterfield teacher rating scaled score	Teacher
Impulsivity (7 questions, 3 points each) ADHD Scale	
Disrupts the class	Teacher
Says thing/does things without thinking	Teacher
Rides bicycle dangerously	Parent
Has many accidents	Parent
Tends to say and do things without thinking	Parent
Satterfield parent rating scaled score	Parent
Satterfield teacher rating scaled score	Teacher
Physical Fighting (2 questions, 3 points each) CP Scale	
Often gets into fights with other children	Parent
Often gets into fights with other children	Teacher
Antisocial Behaviors (12 questions, 3 points each) CP Scale	
Speaks in a rude or sassy way to adults	Parent & Teacher
Irritable, quick tempered	Parent & Teacher
Does not mind, hard to discipline	Parent & Teacher
Lies to get out of trouble	Parent & Teacher

Table 4 (continued)

Uncooperative and resistant to class routines	Teacher
Acts as though not interested in school	Teacher
Satterfield parent rating scaled score	Parent
Satterfield teacher rating scaled score	Teacher
Fire Starting (1 question, 3 points each) CP Scale	
Fascinated with fire, sets fires, lights matches	Parent
Cruelty (2 questions, 3 points each) CP Scale	
Cruel to small children	Parent
Cruel to animals	Parent
Stealing (3 questions, 3 points each) CP Scale	
Steals from other children	Teacher
Takes money from members of his family	Parent
Takes things from other children	Parent
Thrill Seeking (2 questions, 3 points each) CP Scale	
Fearless, reckless	Parent
Looks for thrills and danger	Parent
Fearfulness (1 question, 3 points possible) Protective Scale	
Fearful	Teacher
WISC Verbal IQ (mean=100, SD=15) Intelligence Scale	
WISC Verbal IQ score	Clinician
Socio-economic Class (1 question; low, medium or high) Family Scale	
Socio-economic Status	Parent

For example, there are eleven questions relating to the child's hyperactivity (six questions answered by the parent on the Satterfield Rating Scale, and five answered by the teacher), and each is rated on a three-point scale. The scores will be summed to yield one score for hyperactivity. Because there are eleven questions and three points possible on each question, the hyperactivity index score would be based on a 33-point scale (11 questions X 3 points each). The higher the composite score, the more severe the hyperactivity. This process was completed for all nine of the childhood behavior variables. The final two variables on the chart are based on different scales. The WISC-R has a mean of 100 and a standard deviation of fifteen and the socio economic class variable is based on a 3-point (low, medium, high) scale.

- **Criminal History Records**

Individual criminal history records were computer-generated at the California Correctional Agency, to determine if each participant had any prior contacts with the criminal justice system in

California. The Secretary of the State of California's Youth and Adult Correctional Agency, Senator Robert Presley gave approval for this endeavor (see attached documentation in **Appendix A**). The records are federal reports listing both arrests and convictions for all crimes committed in the state of California since the participant turned 18. Uniform access was not given to the participants' juvenile criminal histories.[7] From these records all participants could be placed into one of four offender status categories (to be discussed) based on the amount and type of crime engaged in.

Admittedly, there are limitations to studies using official records as their only measure of crime. Since official offense histories only record crimes that result in arrest and/or conviction, there will be a certain portion of undetected crime that is not being measured. Some bias is inherent in this type of design, however, and the strengths of using official records far outweigh the potential weakness associated with them. These strengths include the ability to compare the cohort's results to other populations of known offenders and to avoid the inaccuracies of self-report measures (which would be functionally impossible to obtain in this case).

C. Defining Chronicity

The works of multiple theorists were consulted to operationalize the outcome variable, offender status. The variable has four levels: chronic; borderline chronic ["borderline" below]; non-chronic, non-borderline ["non-chronic" below], and non-offender. There is a substantial body of research describing chronic offenders, yet the definition and application of this term is not always consistent. Four common ways to measure recidivistic criminal behavior will be discussed below. They include: police contacts, court referrals, arrests, and convictions.

In two well-known cohort studies (Wolfgang, Figlio, Selin, 1972; Tracy, Wolfgang, Figlio, 1990), juvenile delinquency was recorded until participants reached their eighteenth birthday. Due to the youth of the participants, a lenient standard of "police contacts" was used (which included status offenses and liquor violations), instead of arrests or convictions. A participant

[7] Numerous studies have shown that the younger a participant is at the time of his first arrest, it is more likely that he will commit multiple offenses in the future (Farrington, Loeber, Van Kammen, 1990; Wolfgang, Figlio, Selin, 1972). However, this research team was not given access to all juvenile records and will therefore, be unable to determine whether or not each participant had a juvenile offense history at all, much less at what age they were first arrested. Although this has been used in other research with a great deal of predictive validity, I will be unable to include it in the current study.

was labeled a chronic offender if s/he had five or more police contacts before s/he reached eighteen years of age. Other studies have used referrals to juvenile court as a method for quantifying criminal behavior (Snyder, 1988), with chronics having four or more referrals. Still others gauge serious, chronic offending by identifying probands who have engaged in three or more criminal activities resulting in arrest (Elliott, 1994).

Since Farrington's research is the most relevant to the current study, two of his standards were examined. First, he researched criminal outcomes of young adult males (juveniles up to their 25th birthday) who were diagnosed with hyperactivity and conduct problems as children. He used six or more convictions—*including juvenile convictions*--as the measure of chronic offending (Farrington, Loeber, Van Kammen, 1990). The current study focuses on a lengthier span of adulthood, but none of a participant's adolescence. Farrington's second standard classified chronic offenders as those with five or more convictions between 21 to 40 years of age (Farrington 2000). This age range is the most similar to the current study, so before examining our own participants' criminal histories, it was agreed upon that this standard was a good place to begin.

For the purpose of the current study, five different standards of the severity and/or chronicity of adult criminal behavior were utilized. The first three standards are as follows: Farrington's 1990 standard of six or more convictions, Farrington's 2000 standard of five or more convictions, and one standard that was created after looking at the raw outcome data. This third standard is based on both felony convictions and time sentenced. It was created in an effort to capture not only repeat offenders, but also those committing more serious crimes. For example, using either of Farrington's criteria it is still possible to include repeat drug users or habitual shoplifters in the chronic population and this study seeks to identify a more deleterious type of offender. Therefore, the third standard defines chronics as those participants with three or more felony convictions and five or more years sentenced to jail and/or prison. This standard was arrived at after examining the participant's outcome measures, but before linking them to the childhood data. Although this process is somewhat exploratory, the same standard was similarly

applied to the Multimodal Treatment Group, in an effort to replicate the findings (see MMT Statistical Results, **Section VII**).

Another measure of chronicity and seriousness completely unique to this study (because of the exceptional data available) was an appropriate combination of months sentenced to probation and months sentenced to jail or prison.[8] An equation was constructed that reflected a balance between probation and jail/prison time. These months could not simply be added because a month sentenced to prison suggests a more serious crime than a month sentenced to probation (and a number of the participants had be sentenced to many months of probation and very few months in prison.) This decision-making process will be described in detail later in the statistical results sections.

The fifth and final measure used to define chronicity was based on a scale of offense seriousness created by Cormier and Lang and described by Quinsey, Harris, Rice, and Cormier (1998). Each conviction is assigned a score that quantifies the seriousness of the criminal activity. Homicide is the most serious offense listed on the scale and receives a score of 28, whereas drug possession, a much lesser offense, earns the offender a single point. Once all of the participant's crimes are assigned a score, and a sum total was derived for each participant, they were placed on a continuous scale ranking the seriousness of their offenses according to this criteria.

Since research on chronic offending is still in its neophyte stages, this study had to be somewhat exploratory as well. It was hoped that one or more of these definitions of chronicity would show significant results, which could help elucidate a clearer path for future research. Based on the literature it was expected that the chronic offenders would have some unique childhood attributes – or, more likely, some unique *combination* of attributes – and that these early behaviors would have some predictive power regarding offender status. To the best of my knowledge, no study to date has sought to identify the specific childhood variables, measured during childhood, that differentially characterize chronic adult offenders.

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[8] The proportion of a sentence actually served can fluctuate according to good behavior and time already served, which is why the judge's sentence was used as a more stable indicator of seriousness.

B. The Initial Research Process

The names of the participants in the Satterfield cohort were culled from the original data and assigned a unique record number (URN). This process encrypts pieces of the participants demographic information (i.e., date of birth and portions of the name), so that a unique number is generated which maintains participant anonymity. Shortly thereafter, criminal records were obtained at the California Juvenile and Adult Corrections Agency, Office of Research, by the generation of a criminal history printout for each of the participants, to determine the extent to which they have been arrested and/or convicted for criminal behavior since they turned 18. Up until this point, the raw data concerning childhood behavioral characteristics compiled by Satterfield was kept blind to the researcher collecting the criminal history data. Before comparing the participants' criminal histories with their childhood data, the participant's names from the childhood dataset were deleted, leaving a dataset with URNs only and no personal identifiers.

Finally, Dr. Satterfield's data describing the early lives of the boys was examined and aggregate scores for each of the predictor variables was calculated. Each participant was then placed into four levels of the outcome variable: chronic, borderline, non-chronic, non-offender. Various statistical procedures were used to determine whether the participants in the chronic offender category displayed a unique cluster of these behavioral, cognitive, affective, and intra-familial factors during their childhood.

VI. Statistical Results from the Drug Treated Group

The purpose of this research was to investigate the hypothesis that chronic adult male offenders have unique characteristics in childhood, which make them different from other male non-chronic offenders and non-offenders. To examine this hypothesis, multiple statistical methods were used in an effort to understand this complex issue and to minimize the weaknesses in the data. This study is somewhat exploratory in nature due to the lack of previous research on ADHD and chronicity that tests a consistent paradigm, and as such, the following statistical results should be interpreted cautiously and as a prelude to future research.

A. Predictor Variables

As mentioned previously, there are eleven predictor variables: hyperactivity, impulsivity, physical fighting, antisocial behavior, fire starting, cruelty[9], stealing, thrill-seeking, fearfulness, verbal IQ, and socio-economic class. Below, **Table 5** indicates the number of points possible for each of the predictor variables, with the means and standard deviations listed for each.

Table 5. Descriptive Statistics for the Predictor Variables

Predictor Variable	N	Min Obtained	Max Obtained	Points Possible	Mean	Median	Standard Deviation	Coefficient Alpha
Hyperactivity	80	14	32	33	26.8	27.4	3.8	.74
Impulsivity	79	5	20	21	14.1	14.5	4.0	.67
Fighting	82	0	6	6	3.8	4.0	1.7	.42
Cruelty	86	0	6	6	1.0	0.0	1.5	.58
Stealing	79	0	8	9	3.1	3.0	2.3	.49
Fire Starting	88	0	3	3	0.8	0.0	1.2	-
Antisocial	67	7	24	31	20.1	20.5	5.8	.75
Fearful	84	0	3	3	0.8	1.0	0.9	-
Thrill Seeking	87	0	6	6	3.7	4.0	2.0	.72
WISC	77	69	134	-	97.4	96.0	14.4	-
SEC	88	1	3	3	2.0	2.0	0.7	-

Reliability analyses were run on the individual questions that make up each of the aggregate scores to see the extent to which each of the questions were related to one another. For example, if a parent gave the child a high score on one of the hyperactivity questions (restlessness) would they also score the child high on other hyperactivity questions (e.g., fidgets,

[9] An attempt was made to create a callous/unemotional variable similar to a factor found on the Hare Psychopathy Checklist-Revised (1991), in other research by Farrington (2000), and Frick & Ellis (1999). The variable included questions about being uninterested in school, lying and cruelty. However, a factor analysis indicated that the uninterested in school and lying questions loaded with the other antisocial behaviors, whereas the cruelty questions loaded separately.

or talks a lot)? Similarly, if the parent rated the child high on restlessness, would the teacher's rating on the same question be similar? About half of the alpha coefficients were above .7, which is considered an acceptable level of concurrence among the individual questions. However, fighting, stealing and cruelty were not very homogeneous (.42, .49, .58, respectively). This could be due to a variety of factors. For instance, the fighting aggregate score is made up of the same question ("often gets into fights with other children") asked to both the child's parent and his teacher. Since it is the same question it seems reasonable to assume that the responses would be similar. However, it is common for a child to behave differently in different situations (i.e., home and school). It is important to note this limitation; however, it does not mean that the three low alpha scores will be excluded as valid predictor variables.

To further explore this issue, factor analyses were generated for each of the predictor variables that were made up of two or more questions (hyperactivity, impulsivity, fighting, cruelty, stealing, antisocial, thrill seeking). Initially, the computer created only two factors when questions from all of the seven predictor variables were entered. Upon closer inspection it was determined that all of the questions answered by the child's teacher were loading with other teacher questions, and the questions where the parent was the respondent were loading with other parent questions. This is fairly common when data has been gathered from two different sources and can be explained in one of two ways: differences in what the respondent is observing or differences in the respondent themselves. For example, if the participant is an only child, he doubtless behaves differently at home than he does when he is interacting with multiple children at school; therefore, the parent and the teacher are seeing different aspects of the child's behavior. In the second situation, the parent is unconsciously comparing the child to his/her other children or other children s/he knows, but the teacher is comparing the participant to other students in class or other children from his/her experience and as a result, the differences in the respondents' frames of reference cause a dichotomy in the participant's scores. Alternately, the parent gives the child elevated hyperactivity scores in an effort to get him into the study so that he will receive treatment, whereas the teacher is not similarly motivated. Despite the problem this produces with concurrence among variables, it is for exactly this reason that it is important to

have multiple respondents. Instead of having a limited scope, multiple respondents have different viewpoints and motivations and can see different facets of the child's behavior which expand and enrich the quality of the data.

A decision was made to run two separate factor analyses so that the parent and teacher questions could be evaluated separately. In general, when looking at the parent questions, the hyperactivity questions were split between two factors but they did not correlate with anything else. The impulsivity and thrill seeking questions loaded together on the same factor which intuitively makes sense. Cruelty and antisocial behaviors each had their own factor. And lying and stealing loaded together rather than with other antisocial behaviors. The teacher ratings were somewhat similar. Hyperactivity and impulsivity loaded together but there were no thrill seeking questions asked on the teacher questionnaire. The antisocial questions were split between two factors. The first factor captured more of the sassy and irritable behaviors while the second seemed to reflect an attitude of not being interested in school and other uncooperative types of behaviors. The lying and stealing questions still loaded together; however, a decision was made not to combine them because although they seemed to co-vary, it was hypothesized that stealing was an early form of criminal behavior and if there was a significant link to future criminality we did not want to obscure this result. In the future researchers might want to combine these variables because, at least is the case with this data, the two seem to be highly correlated.

There were four factors on the factor analysis of the teacher questions. The percentage of variance explained was 77.25%, indicating that, when taken together, the four factors account for roughly three-quarters of the variance. On the factor analysis of the parent questions there were six factors, which accounted for 68.80% of the variance. Therefore, the despite the two additional factors, the parent questions accounted for slightly less of the total variance, which means that it allows for more error in the overall pattern of correlations.

B. Missing Data

There are 127 male participants in the drug treated group with childhood data. Thirty-seven of these participants were not found during the DOJ's record search. This means that the participants were not in their computer database, which covers people who not only have a

criminal record but also people who applied for a job that required fingerprinting, and people who have applied for a California Driver's License. There are multiple scenarios to explain why a portion of participants were not listed in the database. The participant might have relocated outside of California where he may or may not be committing crime. He may have committed crimes in California, which have gone undetected. He might not have committed a crime nor applied for any type of license. In any case, we knew too little about these "not found" participants to classify them as "non-offenders", so they were dropped from the analysis. This brought the total number of participants in this group down to 90.

Some of the 90 participants who had valid adult data were missing some portion of their childhood data. When initial analyses were run, there were strong correlations between the missing indicators and the predictors, although this was not expected. Upon closer examination, it was determined that a few participants who were missing entire questionnaires (either the parent or teacher) were causing this result. In all, six participants had a complete parent questionnaire, but the teacher's was missing and two participants who had the teacher questionnaire were missing the parent's. New variables were created for each of the predictor variables that recoded all missing data as zero and all valid data as one. Bivariate correlations were run on the original predictor variables and the new recoded variables. Once the eight participants who were missing entire questionnaires were removed, all of the correlations became non-significant (>.01). The proportion of valid data also improved once the eight participants were removed.

Table 6. Proportion of Valid Childhood Data

Predictor Variable	Proportion of Valid Data All Participants	Proportion of Valid Data 8 Participants Removed
Hyperactivity	.89	.96
Impulsivity	.88	.95
Fighting	.91	.99
Cruelty	.96	.98
Stealing	.88	.95
Fire Starting	.98	1.00
Antisocial	.74	.82
Thrill Seeking	.97	.99
Fearfulness	.93	.99
WISC	.86	.88
SEC	1.00	1.00

Although there are still some miscellaneous items that were not completed by the parent or teacher this is apparently a random event rather than a pervasive pattern. Now that the pattern was identified, the eight participants were put back into the sample. These participants could still be used even though they were missing the entire teacher questionnaire, for example, because all variables that used questions from the teacher questionnaire were recorded as missing, and variables that included only questions from the parent questionnaire (i.e., fire starting, fearfulness, SEC) were used and linked to the participant's adult criminal history. If a participant was missing the entire parent questionnaire, the variables that included teacher questions only were used and then linked to the participant's adult criminal history.

C. Outcome Measures

The first and most general method by which the outcome data was analyzed tried to discern whether there were differences between adult offenders and non-offenders. There were a number of outcome measures available pertaining to some facet of adult criminality that focused on offender/non-offender differences. They included: number of adult arrests (juvenile arrests are excluded), number of felony convictions, total number of convictions (misdemeanor and felony), and number of months sentenced to a correctional facility (jail and prison combined). The following table provides descriptive statistics for these four measures for the Drug Treated Only (DTO) Group.

Table 7. Descriptive Statistics for the Outcome Measures

Outcome Measure	N	Minimum	Maximum	Mean	Median	Standard Deviation
Arrests	90	0	34	4.9	2.0	7.1
Felony Convictions	90	0	9	1.0	0.0	1.9
Total Convictions	90	0	21	2.3	0.5	3.8
Time Sentenced (in months)	90	0	418	24.9	0.0	62.0

For all but arrests, the most common score on an outcome variable was zero, indicating that although most participants had been arrested, the majority of them had never been convicted and thereby never received a jail or prison sentence. Most of these are the non-offenders (offenders must have been convicted, not just arrested) which would later serve as a comparison group. The distance between the mean and the median on the time sentenced variable indicates

that there are some outliers with long prison sentences pulling up the mean. Most of these outliers are repeat offenders with lengthy prison stays and were the central focus of this research. Initial analyses on the participants with adult data are shown below, including the percentage of participants with criminal activity. In parentheses are the number of participants out of a possible ninety.

Table 8. Percentage of Participants with a Criminal History

Measure	None	At least One
Arrests	30.0% (27)	70.0% (63)
Felony Convictions	65.6% (59)	34.4% (31)
Total Convictions	50.0% (45)	50.0% (45)
Months Sentenced to Jail or Prison	52.2% (47)	47.8% (43)

In this high-risk cohort, roughly two-thirds of the participants had been arrested at least once as an adult, one-third had at least one felony conviction, exactly half of the participants had at least one misdemeanor or felony conviction, and almost half had been sentenced to at least one month in jail or prison. Clearly, the initial speculation during childhood that this was an at-risk group seems to have been correct. However, for the purposes of this study, the focus is not just on the offenders but instead on the chronic, repeat offenders who are committing many serious offenses.

D. Hierarchical Polynomial Regression

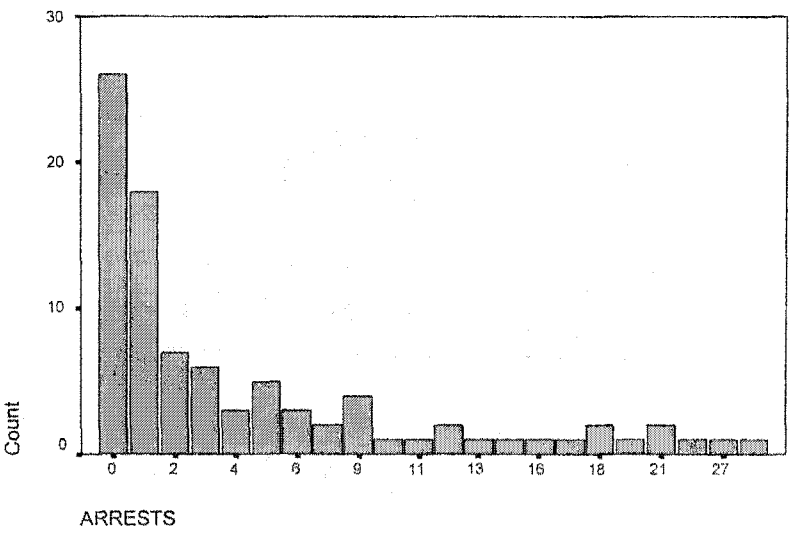
Linear regressions were run to discover if two or more of the variables could be used in the same equation to successfully predict any of the offender/non-offender outcome measures. Since this type of regression uses continuous data, the four outcome measures taken from the participant's criminal histories (arrest, felony conviction, total conviction, time sentenced) were used. To set up this type of regression, all of the predictor variables were subtracted from the mean so that the scores would be centered. Then each of the eleven predictor variables were squared and cubed because a straight line relationship was not expected. SPSS computed all of the statistics for each block, adding the variables one at a time, indicating whether or not each new variable added to the prediction above and beyond those already in the equation. In block one, hyperactivity was used to predict number of arrests. In block two, hyperactivity and

(hyperactivity)^2 were used as predictors and in block three (hyperactivity)^3 was added to the other two. The final model was constructed as follows:

$$y=B_0+B_1(x)+B_2(x^2)+B_3(x^3)+e$$

Since there are eleven predictor variables and four outcome measures, 44 Ordinary Least Squares (OLS) regressions were run. Cruelty was not significant in the arrest regression, but it was the best predictor of whether or not participant's had any convictions, felony convictions, or any time served (all reaching .05 significance) but the polynomial terms did not add anything to any of the equations. Indeed further examination of the data (below) indicated that the cruelty variable was better able to predict non-offending rather than degrees of offending. That is, participants who scored zero on the cruelty variable were almost always non-offenders. However, upon closer examination of the distributions of the outcome measures it was determined that that the data was skewed toward the high end and not normally distributed. For example, most participants have zero arrests, some have one arrest, fewer have two arrests, and even fewer have three, etc. This is also true for felony convictions, total convictions, and time sentenced as well (for those figures, see **Appendix B)**.

Figure 1. Bar Graph of Number of Participants by Number of Arrests



Due to the skewed distribution, the participants with zero scores on the outcome measures were removed from the analysis. This brought the totals down to 63 participants in the arrest regression, 31 participants in the felony conviction regression, 45 in the total conviction

regression, and 43 in the time served regression. The 44 regressions were re-run, this time saving the unstandardized residuals. The normality tests for each one of the residuals yielded results that were highly significant. This means that the p values for the OLS regressions could be inflated because this outcome data is violating the assumption that the residuals are normally distributed. To help bolster these results, logistic regressions were generated because they are not limited by the same assumptions as OLS.

E. Logistic Regression

First, a regression was run to determine whether offenders (participants who had been convicted of at least one crime) had a distinct collection of childhood behaviors that made them fundamentally different from the non-offenders. Logistic regression is an appropriate model for analyzing offending versus non-offending due to the fact that the dependent variable is dichotomous, yielding only two possible values. Furthermore, if significant, the regression equation can describe the *probability* that a participant will be an offender or non-offender, given certain childhood characteristics. As mentioned previously, there were exactly 45 participants in both the offender and non-offender groups. Results indicated that the offenders displayed more antisocial and impulsive behaviors, were more likely to engage in physical fights, and to steal from their family or classmates. These results are consistent with other research depicting the differences between offenders and non-offenders, and therefore reassuring but not surprising. However, this was not the true purpose of this research which was to determine whether chronic offenders could be teased out from other offenders based on their childhood behaviors.

To summarize cruelty, antisocial behavior, impulsivity, physical fighting, and stealing all differentiated between offenders and non-offenders using a variety of different statistical tests. Turning now to the chronicity standards, different combinations of the four outcome measures were used to create dichotomous outcome variables that captured serious, chronic criminality as best as possible. As mentioned previously, there is no true consensus in the literature detailing exactly how to define chronicity, so much thought was given as to which standards would be appropriate. Each of the columns on the following table was designed to capture all of the

participants in one of its' four mutually exclusive categories. The three standards were tested separately in an effort to determine if one was superior to the others.

Table 9. Various Standards Used to Define Chronic Criminal Activity with Number of Subjects per Group in Italics

	Standard #1	**Standard #2**	**Standard #3**
Non-offender	No known adult convictions *DTO=45, MMT=22*	No known adult convictions *DTO=45, MMT=22*	No known adult convictions *DTO=45, MMT=22*
Non chronic/ Non borderline	Three, two or one conviction (misdemeanor or felony) *DTO=24, MMT=24*	Three, two or one convictions (misdemeanor or felony) *DTO=24, MMT=24*	All other offenders *DTO=29, MMT=26*
Borderline	Four or five convictions (misdemeanor or felony) *DTO=10, MMT=5*	Four convictions (misdemeanor or felony) *DTO=6, MMT=3*	Three or more felony convictions but less than five years in jail/prison or less than three felony convictions but five or more years in jail/prison *DTO=5, MMT=6*
Chronic	Six or more convictions (misdemeanor or felony) *DTO=11, MMT=12*	Five or more convictions (misdemeanor or felony) *DTO=15, MMT=14*	Three or more felony convictions and five or more years in jail/prison *DTO=11, MMT=9*

To ensure that there were only two possible choices for each outcome variable, the chronic offenders were compared with the non-chronic/non-borderline offenders while the non-offenders and the borderline subjects were removed from the analyses. For the first two standards (6+ convictions, and 5+ convictions) the results were the same; hyperactivity was the only variable that was significant at the .05 level. This indicates that chronic offenders who got caught and convicted repeatedly tended to display more hyperactive traits during childhood than other, less recidivistic, offenders. Other researchers have downplayed the link between hyperactivity and criminal offending often finding that hyperactivity was only significant when combined with other conduct problems or antisocial behavior, but here the conduct problems were not significant which clearly went against our predicted hypothesis. The implications of these findings will be detailed in the discussion section.

In the regression using the third standard, none of the predictor variables were significant. This standard is somewhat more refined and a better judge of offender seriousness, but unfortunately all of the chronicity regressions are plagued by low n. The frequencies for the

three chronic groups ranged from 11 to 15 and that could be obscuring some results. It was hoped that this could be rectified once the data from the MMT group was examined and possibly combined with the DTO group to yield a higher n.

F. A Closer Look at Time Sentenced

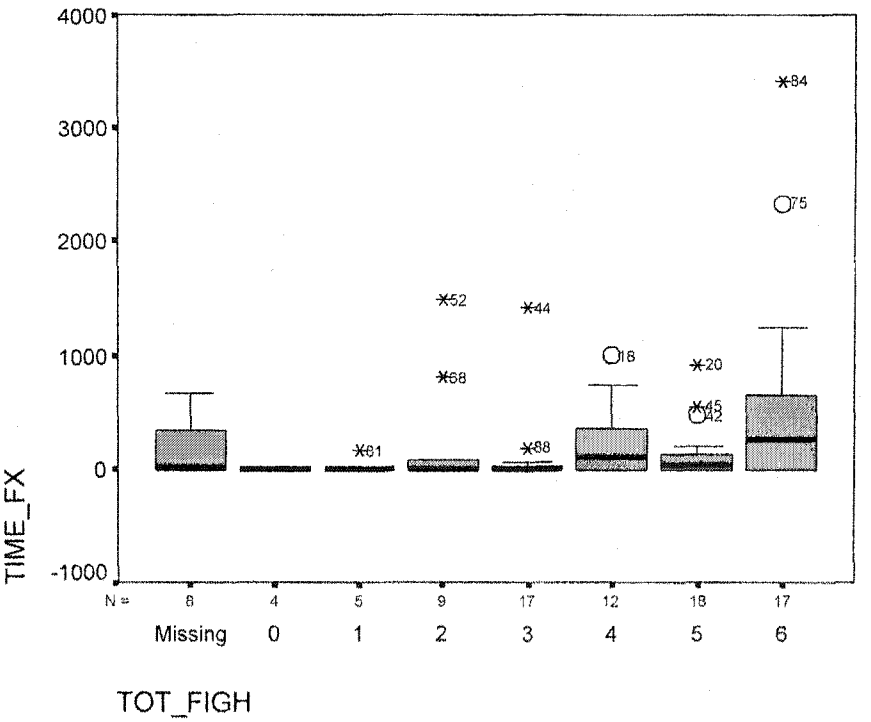
This research team had unprecedented access to all of the participants' sentencing data. Because sentencing information on jail, prison, and probation were available, it seemed irresponsible to not utilize the probation data. After a literature search revealed no prior research detailing how these three measures could be combined to yield one overall time sentenced number, an attempt was made to create an acceptable method. It was hoped that jail, prison, and probation could be multiplied by different weights so that each of the terms would be on a similar scale to then be added together. Intuitively, jail and prison should be more heavily weighted than probation. For instance, was twelve months on probation equal to one month in jail? Or should this standard be higher or lower? Based on an inspection of the outcome data, looking for what multipliers seemed to capture the sought after relationship, a decision was made to treat jail and prison time similarly, multiplying them by eight, while keeping probation the same in an effort to weight the variables appropriately. The following equation was performed on all of the 90 participants' time sentenced data:

Time_Fx = 8(jail sentence + prison sentence) + probation sentence

Once this transformation was complete, the participants with zero time sentenced stayed at zero, but the other offenders now spanned a greater range (maximum 3410 months). The mean sentence was 235 months and the standard deviation was 523. As was the case with all of the outcome data in this study, the time sentenced function was skewed towards the high end because most of the participants had a zero time sentenced score. Because the data were not normally distributed, a non-parametric test was used because it made no assumptions as to the shape of the population distribution, nor homoscedasticity. The Kruskal-Wallis was selected because it allows for more than two groups of the predictor variable and determines whether the distribution of scores in the groups is what you would expect under a null hypothesis of no difference. It was used for all variables with eight or fewer possible summed responses, which

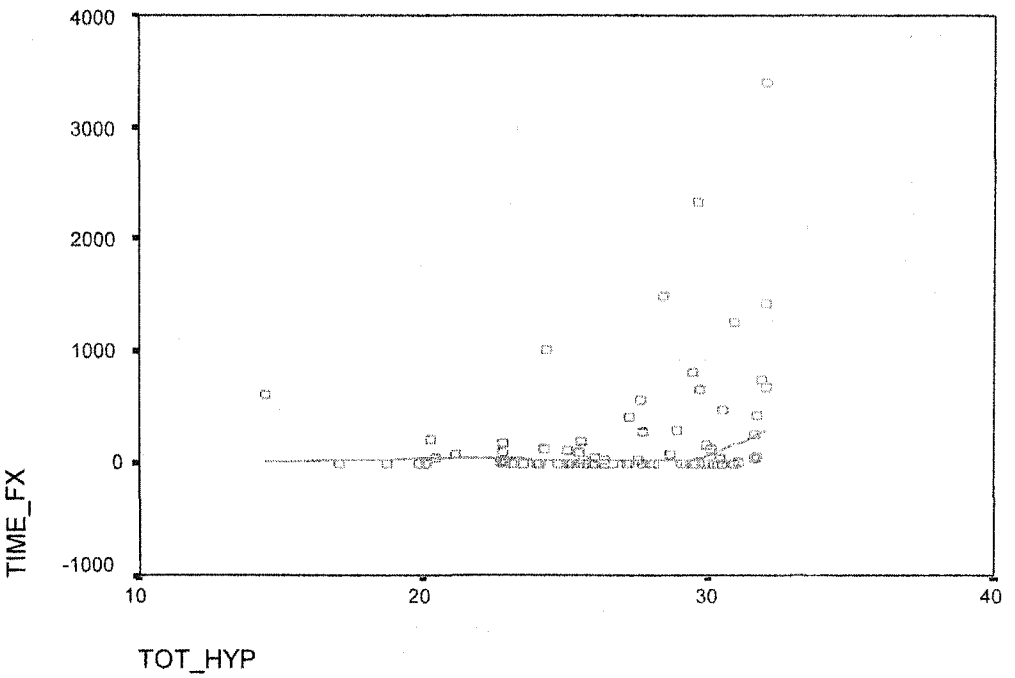
included: cruelty, physical fighting, and thrill seeking. Hyperactivity had to be tested using a different statistic. Because more than five participants were in each group, the sampling distribution is approximately chi square. Out of the three predictor variables, only physical fighting was significant. With six degrees of freedom, a chi square of 6.529, and a p value of .047 it was barely able to reject the null hypothesis. When a box plot of physical fighting and the time sentenced function was created, it was determined that the relationship between the two variables may have been somewhat artificial because it was being inflated by eleven outliers appearing above the third quartile. **Figure 2**, below shows the many outliers that could have caused the narrowly significant results on the Kruskal-Wallis. In any event, another Kruskal-Wallis was run excluding participants with no time sentenced to see if physical fighting was able to distinguish between the forty-five offenders who had been a time sentenced function score greater than zero. The results were not significant χ^2 (5, M=41) =8.291, p=.141, indicating that physical fighting was better able to distinguish offenders from non-offenders rather than serious, chronic offenders from other offenders.

Figure 2. Graph of Physical Fighting and the Time Sentenced Function



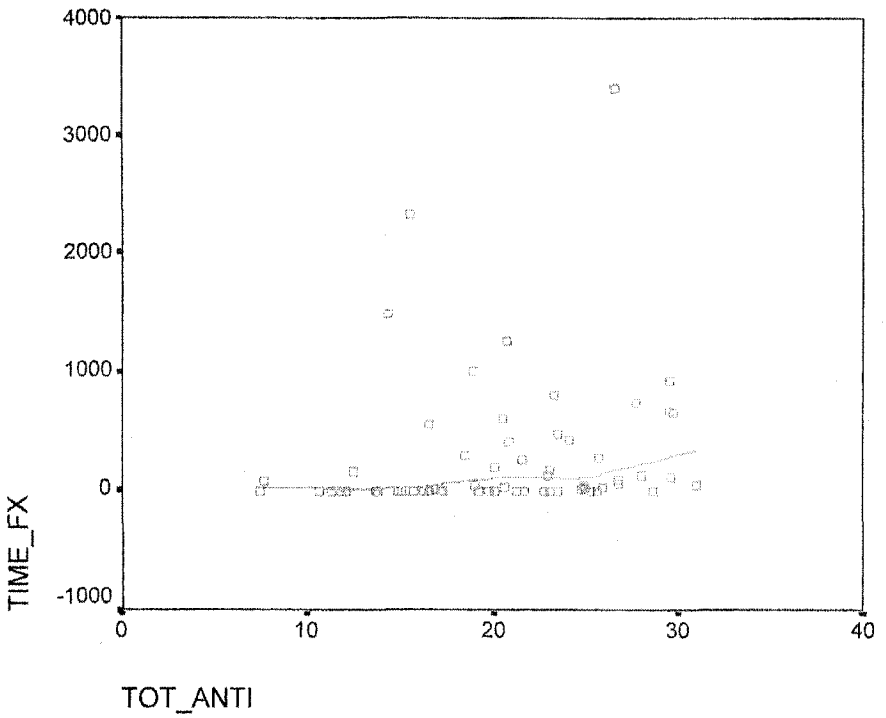
Variables with more than eight possible response categories needed to be tested using a non-categorical analysis. Hyperactivity was tested using the Spearman's rho (ρ) statistic, a non-parametric test for data that has both continuous predictor and outcome data. Hyperactivity was significant ρ (N=80) =.273; p=.014 and a scatterplot of the data showed no relationship until the higher values of hyperactivity (≥28) were reached, indicating that the extremely elevated predictor scores show some association with the time sentenced function whereas the low or even moderate range of scores show no such association. The relationship between hyperactivity and the time sentenced function is graphically displayed on the scatterplot below.

Figure 3. Scatterplot of Hyperactivity and the Time Sentenced Function



An interesting relationship was uncovered between antisocial behavior and the time sentenced function. Spearman's rho indicated that it was a significant predictor ρ (N=67) =.411; p=.001 so a scatterplot was generated to determine if the same type of relationship existed where the predictive power lies in the tail. The scatterplot, below, shows this to be true as is evident by the slight bend in the lowess regression line when participants' scores reach the higher values of antisocial behavior (≥25).

Figure 4. Scatterplot of Antisocial Behavior and the Time Sentenced Function



No relationship was apparent on the scatterplots for the WISC and impulsivity and this result was confirmed using the appropriate parametric and non-parametric tests.

G. The Cormier-Lang System

Scores for the fifth and final definition of chronicity were derived from a scale ranking each criminal conviction based on perceived seriousness. Because Quinsey et. al. (1998) based it on the Criminal Code of Canada, a few minor changes were made to the scale in order to adapt it for use on the current data set. (For the original scale and a detailed description of any changes see **Appendix C**.) Of the 90 original cases, 64 had at least one or more arrest, but 20 of those had never been convicted of a crime. This brings the participant count for this test down to 44 offenders. When linear regressions were computed for all of the eleven predictor variables, none of the results were significant. This indicates that none of the childhood behaviors were able to significantly predict seriousness of adult offending according to the CL scale. However, when the 20 participants who had a score of zero on the Cormier-Lang (either because they were arrested but never convicted, or because their conviction was so trivial it earned them a zero

score) were added back into the sample, then both cruelty and physical fighting became significant once again.

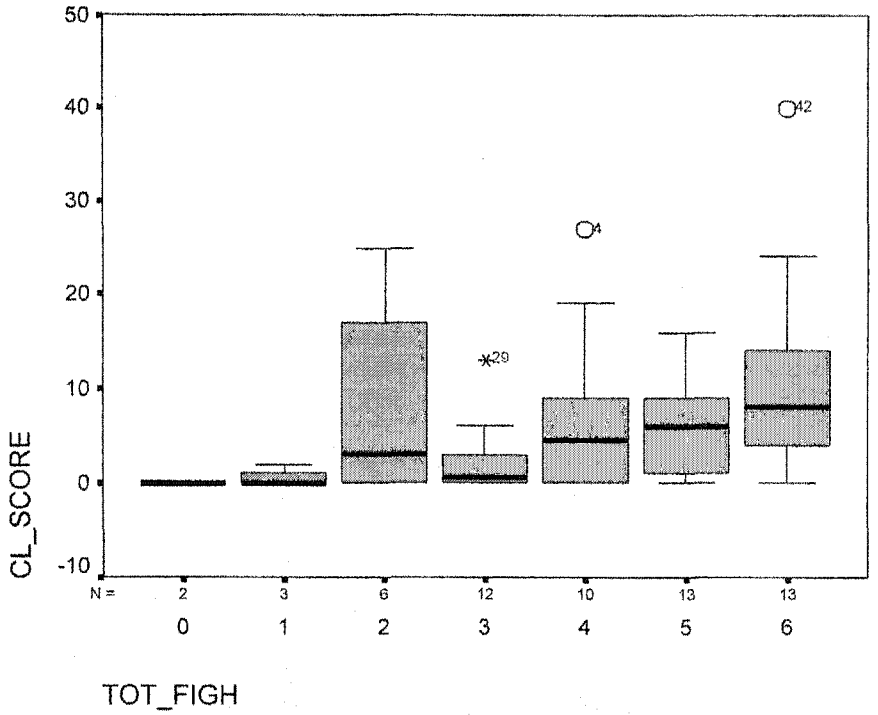
Table 10. Cormier-Lang Bivariate Regression Results

Predictor Variable	b	Upper 95% CI	Lower CI	r=beta	R^2	Sig
Cruelty	1.475	2.817	.133	.277	.077	.032
Physical Fighting	1.522	2.774	.270	.307	.094	.018

The R^2 values do show an improvement in the regression line at predicting Cormier-Lang scores over the mean, and they are higher than the R^2 for the time served function. Although these two variables have repeatedly come up significant, they tend to be better predictors of offending versus non-offending than chronic versus non-chronic offending. This result is repeated here because cruelty and fighting are only significant when the twenty non-offenders are added back into the sample. Unfortunately, they are not as refined at picking up distinctions between scores at the higher end of the scale.

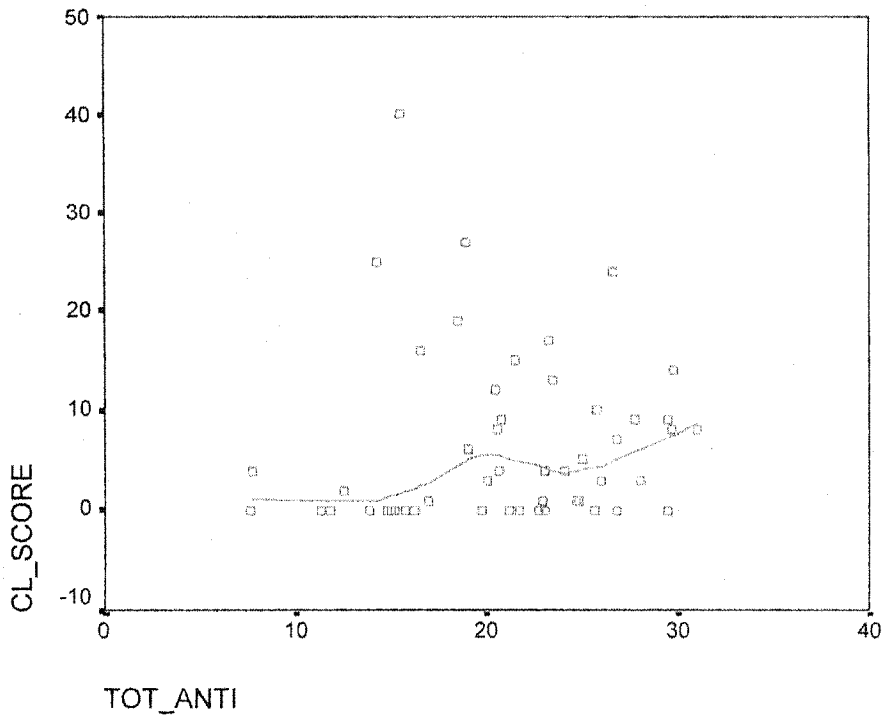
Non-parametric tests were repeated for this standard as well, due to the skewed distribution of the outcome variable. Again, both cruelty and physical fighting were not significant when only the 44 offenders were tested. However, fighting was a significant predictor of Cormier-Lang score when the 20 non-offenders were added back in χ^2 (6, N=59) =12.822, p=.046). The box plot of fighting and CL score support this result.

Figure 5. Boxplot of Physical Fighting and Cormier-Lang Score



Out of all of the other categorical predictors (with eight or fewer possible response categories) only socio-economic class (SEC) was significant χ^2 (2, N=64) =6.677, p=.035) and a box plot showed that the participants from lowest SEC background had higher Cormier-Lang scores. For the continuous predictor variables (hyperactivity, impulsivity, and antisocial behavior) the non-parametric Spearman's rho (ρ) was used. Results indicated that none of these three variables had a significant impact on a participant's Cormier-Lang score. Results for impulsivity and hyperactivity were confirmed by examining fairly straight line on the scatterplots, indicating no relationship. However, when antisocial behavior was plotted, a bend in the lowess fit regression line was evidenced, signifying that once again antisocial behavior has a non-linear relationship to most of the outcome variables in this study. **Figure 6**, below, captures this result.

Figure 6. Scatterplot of Antisocial Behavior and Cormier-Lang Score



The final predictor variable to be tested was the WISC. Because it had a bell shaped curve and was not skewed, a bivariate regression was used. The results showed that a participant's verbal IQ did not significantly impact his Cormier-Lang or overall crime severity score.

To summarize, the offender outcome data in this study was skewed towards the high-end, making the use of parametric statistics problematic. Therefore, a logistic regression was used to see if there were behavioral differences in childhood between participants's who had been convicted of a crime versus those who had not. Antisocial behavior, impulsivity, physical fighting, and stealing were all precursors to later criminality. However, in the logistic regressions testing the three standards of chronicity, hyperactivity was the only childhood behavior score that could significantly predict a chronic criminal outcome. Thus, hyperactivity in childhood did not predict offending in general, it only predicted chronic, repeat offending. Hyperactivity was also a significant predictor in the time-sentenced equations along with antisocial behavior and physical fighting. Finally, on the Cormier-Lang scale, which is designed to yield an overall seriousness score for each offender, physical fighting and SEC were significant.

VII. Statistical Results from the Multimodality Treatment Group

In the early 1970's, when participants first joined the study they were placed into one of two groups: the DTO group received stimulant drug treatment (n=127), and the Multimodality Treatment (MMT) group received a combination treatment approach that included stimulant drugs and intensive psychological treatments (n=99). For the MMT group, an individual psychotherapy plan for each child was developed by a senior clinician using a treatment team approach, with psychological treatments that included: individual, group, and education therapy for the child; individual and group therapy for the parent(s); and family therapy. The average length of treatment for both groups was approximately two years. As mentioned in previous research on the Satterfield cohort, the participants were not randomly assigned. Group assignment was based on the chronological order in which the participant entered the study. When the study began, stimulant drug medication was the primary treatment method for children with ADHD. The first participants to enter the study were treated using this method, because it was the most widely-accepted treatment available at that time. As counseling and therapy became more popular, a second treatment method as added to the study which combined the two approaches. Subsequently, participants who joined the study during the second wave were placed into the MMT group.

A. Predictor and Outcome Variables

Out of the 99 MMT participants, 36 of them could not be found in the DOJ's criminal history record search during adulthood. This brought the number of available MMTs down to 63. The same eleven childhood predictor variables were used and aggregate scores for each were calculated in the same manner as they were for the DTOs. The only difference in the childhood behavior questions was a change in how the socio-economic data were collected. Instead of the three categories (low, medium, high) that the parents of the DTOs had to select from, the MMT parents had six categories to choose from based on annual family income. The six categories available to the MMTs were collapsed into the same three categories as the DTOs so that comparisons could be made. This did not affect the outcome data. The table below shows the

means, medians, standard deviations, and alphas for the 63 MMT participants with adult data. The DTO data are included here for comparison purposes.

Table 11. Descriptive Statistics for the Predictor Variables

Predictor Variables	Group	Mean	Median	SD	Alpha
Hyperactivity	DTO	22.93	23.5	03.31	0.64
	MMT	16.75	17.0	03.21	0.73
Impulsivity	DTO	10.54	11.0	02.94	0.50
	MMT	07.78	07.0	02.65	0.62
Fighting	DTO	03.80	04.0	01.70	0.42
	MMT	02.97	03.0	02.97	0.59
Cruelty	DTO	01.00	00.0	01.50	0.58
	MMT	00.49	00.0	00.49	0.72
Stealing	DTO	03.10	03.0	02.30	0.49
	MMT	01.97	02.0	01.97	0.56
Fire Starting	DTO	00.80	00.0	01.20	-----
	MMT	00.55	00.0	00.55	-----
Antisocial	DTO	18.16	18.0	05.04	0.67
	MMT	12.84	14.0	12.84	0.76
Fearful	DTO	00.80	01.0	00.90	-----
	MMT	00.79	01.0	00.79	-----
Thrill Seeking	DTO	03.70	04.0	02.00	0.72
	MMT	02.12	02.0	02.12	0.70
WISC	DTO	97.40	96.0	14.40	-----
	MMT	98.98	99.0	12.07	-----
SEC	DTO	01.97	02.0	00.73	-----
	MMT	01.87	02.0	00.80	-----

Contrasts between the two groups on childhood behavior measures indicated that the groups were fundamentally different even before they received clinical treatment for ADHD. At this point, a Box's test of equality of covariances was performed to determine if the groups had statistically significant differences in the covariance pattern inherent in group membership. The results were significant ($p=.040$), indicating that although it was initially hoped that the MMT group would cross-validate the DTO results, the non-random distribution of participants had created two unequal treatment groups. The above table makes it apparent that in general, the participants in the MMT group had lower aggregate scores for each of the predictor variables than the DTOs (the reverse is true for the WISC; a higher score indicates the more beneficial behavior). Chi squares were run for each of the scales that had six or fewer possible values (Fighting, cruelty, stealing, fire starting, fearfulness, thrill seeking, and SEC); they indicated that for five of the seven categorical predictor variables, the differences between groups were all highly significant ($p<.005$). The fearfulness and SEC variables have a truncated range (zero to three), which could

have resulted in the non-significant between-group differences. For the continuous variables (hyperactivity, impulsivity, and antisocial behavior), the non-parametric Spearman's rho was used to test for between-group differences. All three of the variables were highly significant ($p<.001$), indicating that, as feared, the DTOs and MMTs had fundamentally different childhood behaviors. Because the participant's WISC scores were continuous and normally distributed, there was no need for a non-parametric test, therefore a standard t-test was used. The differences in each groups' WISC scores were not significant. The differences in the two group's covariance patterns prevented their combination, which left two groups with relatively small n instead of one large group.

Because all of the MMTs' childhood measures are lower, indicating less behavioral problems (except the WISC, where a higher score is more beneficial), it would be expected that this might correspond to lower outcome measures (i.e., criminality). The following table indicates that this assumption turned out to be false. In general, although the MMT group had less childhood behavioral problems than the DTOs, they had higher rates of criminality in adulthood!

Table 12. Comparison of Two Groups on Frequency of Arrests, Convictions, Felony Convictions, and Incarcerations.

	DTO (90)	**MMT** (63)
Arrests		
None	30.0% (27)	20.6% (13)
At least one	70.0% (63)	79.4% (50)
Felony Convictions		
None	65.6% (59)	60.3% (38)
At least one	34.4% (31)	39.7% (25)
Total Convictions		
None	50.0% (45)	34.9% (22)
At least one	50.0% (45)	65.1% (41)
Time Sentenced		
None	52.2% (47)	39.7% (25)
One month or more	47.8% (43)	60.3% (38)

Similar to the DTOs, none of the outcome measures were normally distributed, they were instead skewed towards the high end. The mode for all four outcome measures was zero, because it was the most frequently occurring single value across all four measures of criminality. The means and medians were also comparable between the two groups (Arrests: DTO 4.9, MMT 4.8; Felony Convictions: 1.0, 1.1; Total Convictions: 2.3, 2.4; Time Sentenced: 24.9, 29.0). Chi squares were run to determine if the differences between the two groups were significant.

Results indicated that the higher percentages of MMT criminality did not achieve statistical significance {Arrest χ^2 (1, N=153) =1.329, p=.265; Felony Convictions χ^2 (1, N=153) =.438, p=.609; Total Convictions χ^2 (1, N=153) =3.423, p=.071; Time Sentenced χ^2 (1, N=153) =4.016, p=.050}. Therefore, despite the apparent differences in childhood behavioral scores, it appears that the levels of criminality in adulthood were comparable between the two groups. However, caution must be used in this interpretation due to low power caused by small sample sizes.

B. Bivariate Correlations and Linear Regression Results

A bivariate correlation of the predictor variables indicated that the four behavioral measures (impulsivity, antisocial behavior, stealing, fighting) were all highly correlated with one another. This could mean that these four variables are actually measuring the same early criminality trait, and not the childhood behaviors they attempt to quantify. The 95% confidence intervals and bivariate correlations are listed on **Table 13**, below.

Table 13. 95% Confidence Intervals and Bivariate Correlations between Predictor Variables

	Impulsivity	Antisocial	Stealing	Fighting	WISC
Impulsivity	r = 1	r = .443 **p <.001**	r = .470 **p <.001**	r = .418 **p =.001**	r = .198 p =.130
Antisocial	(.679, .207)	r = 1	r = .564 **p < .001**	r = .767 **p <.001**	r = .177 p=.172
Stealing	(.704, .236)	(.780, .348)	r = 1	r = .555 **p <.001**	r = .078 p =.552
Fighting	(.656, .180)	(.935, .599)	(.773, .337)	r = 1	r = .167 p =.198
WISC	(.164, -.364)	(.034, -.478)	(.229, -.251)	(.172, -.301)	r = 1

Hierarchical polynomial regressions for the predictor variables indicated that both antisocial behavior and the WISC might need polynomial terms because their relationships with the outcome measures were non-linear. For antisocial behavior, the squared term was showing some significant results, primarily for the two conviction measures, but the cubed term was not significant for any of the four outcomes. This indicates that there might be a single curve in the regression line, producing a non-linear result. Upon closer examination of the WISC data, it became apparent that the change was being caused by the WISC score itself, and not its higher order terms. These results are listed in the following table.

Table 14. Hierarchical Polynomial Regression Results

Predictor Variable	R^2	R^2 Change	F-Change	df	Sig
Antisocial	.166	.116	12.228	1	.001
Antisocial, Antisocial^2	.184	.068	7.619	1	.007
Antisocial, Antisocial^2, Antisocial^3	.202	.019	2.133	1	.148
WISC	.091	.091	9.614	1	.003
WISC, WISC^2	.100	.009	.933	1	.336
WISC, WISC^2, WISC^3	.103	.003	.317	1	.575

It was determined that a graphic representation of these two variables might help elucidate their relationship to the total conviction measure. The lowess fit line is included on each scatterplot below to show the non-parametric fit of a curve to a set of points.

Figure 7. Scatterplot and Lowess Fit Line for the WISC and Total Number of Convictions

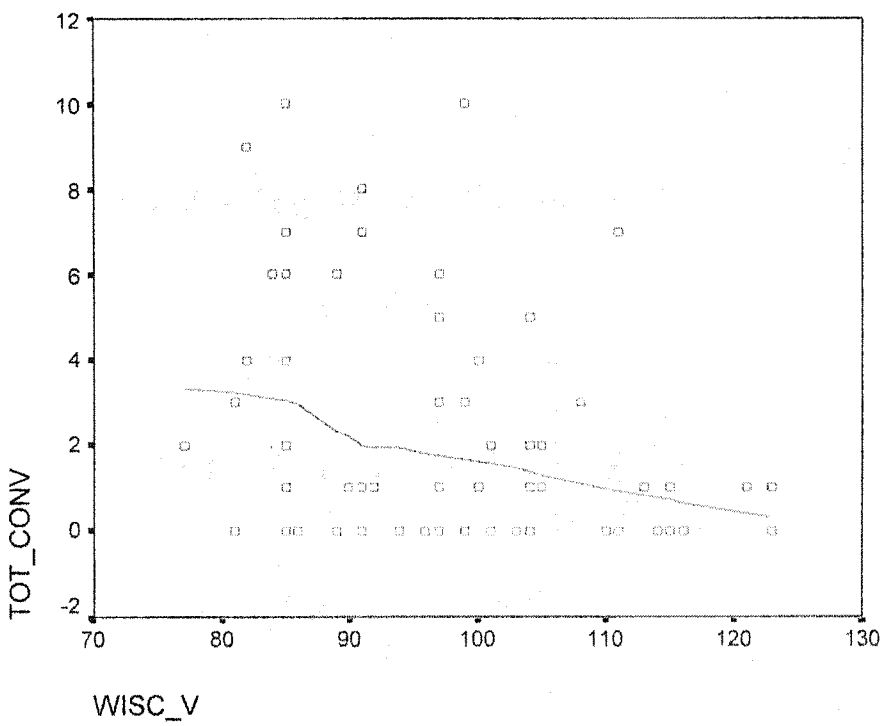
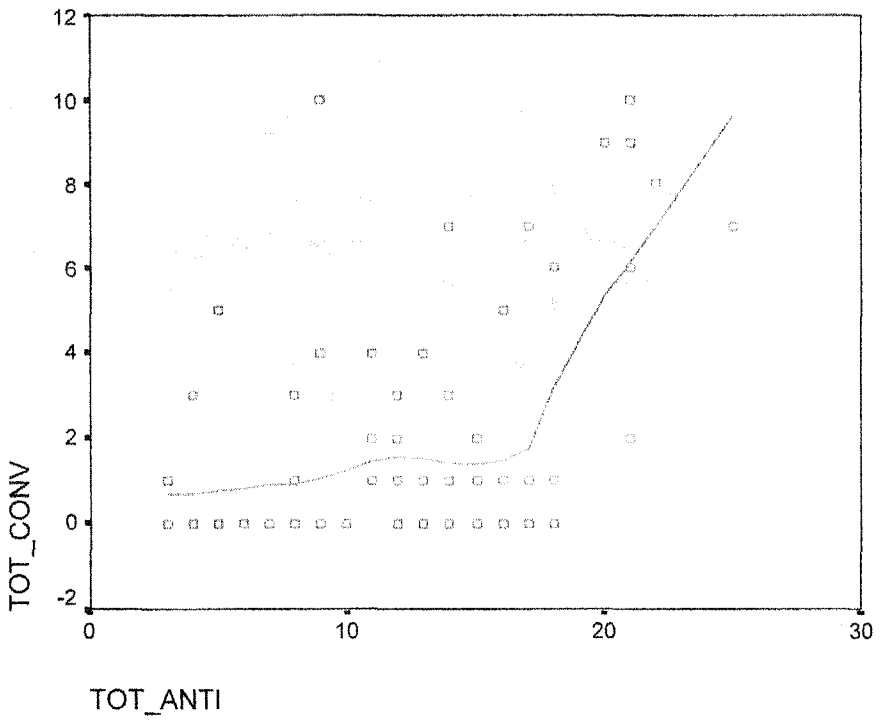


Figure 8. Scatterplot & Lowess Fit Line for Antisocial Behavior and Total Number of Convictions



Looking at the first scatterplot it becomes apparent that not only is the relationship between the WISC and the conviction measure a negative one (as verbal IQ increases, the number of adult convictions decreases), it is fairly linear with only a slight dip in the regression line as the WISC approaches 90. In sharp contrast, the antisocial behavior measure is a J curve with higher values of antisocial behavior producing exponentially higher conviction rates. To determine if it was the WISC or antisocial behavior that was actually causing the change in the conviction rate, the WISC's unstandardized residuals were plotted with antisocial behavior. If the WISC was accounting for most of the change, the scatterplot would show a different relationship; however, the lowess fit line stayed almost identical when it was graphed with the unstandardized residuals. At this point, it was determined that both the WISC and antisocial behavior were correlated with a change in the conviction rate and correlations using the non-parametric Spearman's rho yielded significant scores for both the WISC ρ (N=63) =-.357, p=.004 and antisocial behavior ρ (N=52) =.388, p=.002. When they were added into a linear regression one at a time (WISC in the first block, and antisocial in the second, and then vice versa) the results

were the same; both variables were independently predictive each producing some change in adult conviction rates. These results are shown below.

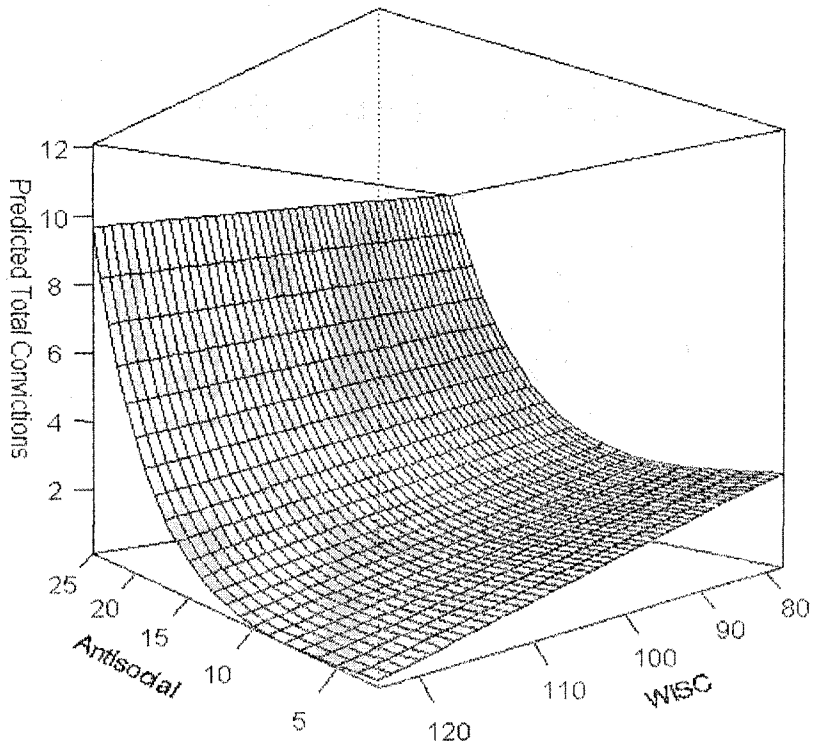
Table 15. Multiple Regression Results Predicting Conviction Rates

Predictor Variable	B	Upper 95% CI	Lower CI	r=beta	R^2	Sig
Antisocial Behavior	.182	.307	.056	.341	.165	.005
WISC	-.066	-.013	-.120	-.292	.246	.016

To capture the non-linear relationship between antisocial behavior and conviction rates, seven different regressions were run using antisocial^2 through antisocial^8 as the predictor variables. The R^2 values were examined for each equation to determine how sharp the bend in the regression surface needed to be. The R^2 values ranged from .250 for antisocial^2, up to .297 for antisocial^4, and down again to .227 for antisocial^8. Since antisocial^4 produced the largest R^2, it was used in the final regression equation and the graph that follows:

Total convictions = 6.918 - .0486(antisocial) + .00002068(antisocial^4) - .0528(WISC) + e

Figure 9. Graph of Relationship of Antisocial Behavior and the WISC to Total Convictions



C. Logistic Regression Results

Individual logistic regressions were run on the MMT participants to help support the preliminary results found using the other parametric tests. The sixty-three participants were first divided into two groups, offender or non-offender, based on their conviction status. Forty-one participants had been convicted of a crime, and twenty-two had not. Seven of the eleven predictor variables showed a significant ability to predict whether a participant would become an offender or a non-offender. All eleven variables are listed below in **Table 16**, and the seven significant equations are found in bold face type. The degrees of freedom for each equation is one.

Table 16. MMT Bivariate Logistic Regression Results for the Offender/Non-Offender Relationship

Predictor Variable	b	S.E.	Wald	Sig	Exp(B)
Hyperactivity	.133	.088	2.303	.129	1.142
Impulsivity	.232	.113	4.176	**.041**	1.261
Antisocial	.160	.060	7.120	**.008**	1.173
Stealing	.484	.208	5.420	**.020**	1.622
Fearful	.916	.415	4.868	**.027**	2.499
Thrill seeking	.491	.229	4.603	**.032**	1.635
Fighting	.537	.199	7.309	**.007**	1.712
Cruelty	.470	.375	1.572	.210	1.600
Fire starting	.138	.357	.149	.699	1.148
WISC	.002	.004	.250	.617	1.002
Income	-.406	.173	5.498	**.019**	.667

It is important to remember that four of the above variables (impulsivity, antisocial behavior, stealing and fighting) are highly correlated with one another. So although they all seem to be good predictors of offending, they are in essence measuring the same underlying behavior. To avoid the misleading effects of correlated predictors, all of the above predictors were put into one multiple regression. In this format, all of the predictors became non-significant and the overall R^2 was .30. Again, these results were not surprising and were just replicating the findings of the DTO offender/non-offender logistic regressions (antisocial behavior, impulsivity, stealing, and fighting were significant, but when all of the predictor variables were placed into one multiple regression, none of the variables could predict a participant's offender status.) However, as mentioned previously, the main hypothesis of this research focuses on what childhood behaviors make chronic offenders different from their non-chronic counterparts.

To reiterate, there are three discrete standards used to define chronic criminal activity in this study. Six or more convictions, five or more convictions, and three or more felony convictions plus five or more years in jail and prison combined (to review the cutoff points for all three standards return to **Table 9** on page 36). In the DTO group, hyperactivity was the only significant childhood behavior for the first two standards and none of the predictor variables were significant using the final standard. Using the six or more convictions standard for the MMTs, antisocial behavior (p=.007), stealing (p=.011), fighting (p=.013), and the WISC (p=.034) were all significant. Again, antisocial behavior, stealing and fighting are all highly correlated with one another and are perhaps actually measuring some early precursor to criminality and this, in combination with a low verbal IQ, seems to be the most predictive of chronic offending. When the standard is lowered slightly to five or more convictions, impulsivity (p=.038) is added back in to early precursor group (antisocial, stealing, fighting, and impulsivity), which are all significant here. Along with this group, the WISC remains significant and hyperactivity also becomes significant (p=.027). This latter finding is the only one that was replicated in both the DTO and MMT groups.

The final standard (three or more felony convictions plus five or more years in jail/prison) was the only one that tried to capture the seriousness of the offenses, and it turned out to be the most rigorous standard. For this standard, only stealing was significant (p=.049) and all of the other previously significant variables dropped below the .05 significance level.

The logistic regressions testing chronicity were again plagued by a low n, with frequencies for the chronic groups ranging from nine to fourteen. The three or more felony convictions plus five or more years in jail and prison was the most stringent standard thus yielding the smallest number of chronics (n=9). Originally, it was hoped that perhaps the DTOs and the MMTs could be combined to generate a higher total number of chronic offenders, but the differences between the groups (caused by non-random assignment) prohibited this possibility.

C. The Time Sentenced Function

In an effort to capture a participant's overall seriousness of criminal behavior, a composite sentencing score was calculated from the participant's rap sheet. This score utilized jail, prison, and probation sentences and attempted to equate all three types of punishment so

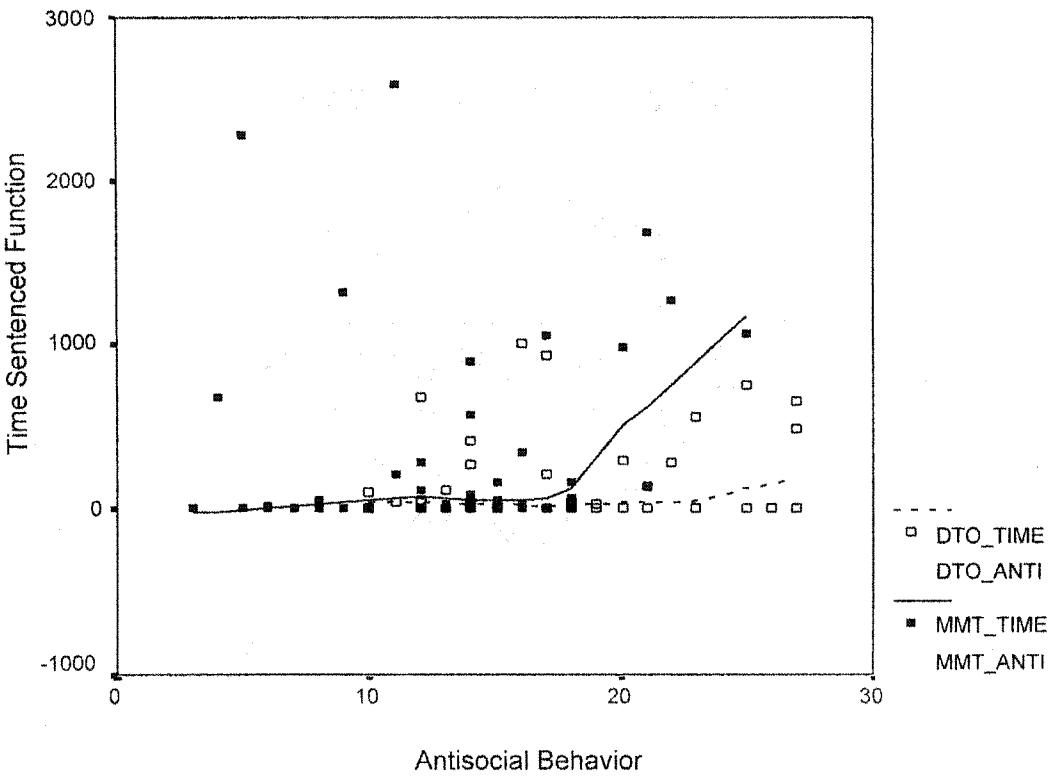
that they could be added together. Just like the DTOs, the MMT's jail and prison sentences were multiplied by eight and then added to their probation sentence. It was hoped that this function would capture a participant's overall seriousness of criminal behavior so this score could then be compared to their childhood behavior data to see if any patterns emerged. The following table lists the descriptive statistics for both the DTO and MMT groups.

Table 17. Time Sentenced: Descriptive Statistics for the DTO and MMT groups

Outcome Variable	N	Minimum	Maximum	Mean	Median	Std. Dev.
Time Sentenced DTO	90	0	3410	235.67	6.00	522.635
Time Sentenced MMT	63	0	2592	283.92	44.00	546.657

Non-parametric tests and graphic representations of the data were used to determine if any relationships existed. Kruskal-Wallis results were examined for seven of the eleven predictor variables with eight or fewer possible values. Thrill-seeking was the only categorical variable that was predictive of the time served function χ^2 (4, N=60) =10.345, p=.035, but upon closer examination of a box and wisker plot, it seemed that four outliers were significantly impacting the results by artificially elevating both a high and low thrill seeking value. Fighting, cruelty, stealing, fire starting, fearfulness, and income were not significant. For the three continuous variables (hyperactivity, impulsivity, and antisocial behavior) Spearman's rho (ρ) was again used for it's non-parametric properties. All three of these variables were significant {hyperactivity, ρ (N=59) =.330, p=.011; impulsivity, ρ (N=60) =.368, p=.004; antisocial, ρ (N=61) =.308, p=.016}. To further understand these relationships, scatterplots were created with the predictor variables on the x axes. Although hyperactivity and impulsivity both showed a slight positive relationship to time sentenced, antisocial behavior once again showed a strong non-linear relationship. The solid lowess fit line, below, shows the relationship between antisocial behavior the time served function for the MMT group.

Figure 10. Relationship of Antisocial Behavior to the Time Sentenced Function



This outcome strengthens the similar results found in the previous section, showing antisocial behavior to be a significant predictor of the total number of convictions in adulthood. This suggests that it is playing an intrinsic role in a participant's criminal involvement. These results are also similar to the DTO findings of antisocial behavior, which are superimposed on the above figure (dotted line and open markers). For both groups the lowess fit line is somewhat flat for the lower values of antisocial behavior and time sentenced, and then as the more extreme values are reached, the line turns upwards.

Finally, bivariate regression was performed on the WISC to determine if it was also somewhat involved in the expected change in time sentenced. And although the 95% confidence intervals did not include zero (lower=-24.070, upper=-1.466) indicating a significant result (p=.027), the scatterplot showed only a slight, negative relationship. The raw regression weight demonstrates that for each positive one-point change in verbal IQ, time sentenced is expected to decrease by 12.8 function points. These results indicate that antisocial behavior in childhood,

amongst relatively hyperactive children, plays a significant role in predicting criminal involvement; however, this relationship as can be seen from **Figure 9**, at least with regards to total convictions this relationship can be somewhat moderated by an elevated verbal IQ (or worsened by a below average IQ). Perhaps the ability to express oneself can help ease a person's antisocial tendencies (or help him talk his way out of being punished once he has been caught!). Whatever the relationship, an attempt has been made to further explore these results in the next section, which also endeavors to quantify a participant's criminal involvement.

D. The Cormier-Lang System

To review, the Cormier-Lang (CL) system is used to measure each participant's criminal activity and to generate a number which represents the severity of a combination all of the participant's crimes. For the MMT group, this number ranged from zero to fifty-four, with most of the participants clustered around the scores zero and one. For a participant to receive a zero CL score, they must have been arrested at least once but never convicted of a crime, or convicted of an insignificant offense (i.e., evading a railroad fare) that is worth zero points on the scale. There were ten participants who fell into this category and they were included in the total n of fifty. There were also thirteen non-offending participants who were never arrested, and instead of confounding the results of the participants who received a zero CL score, these thirteen participants were not included in the analysis. The mean score was 8.26 while the median was 4.50 indicating that the mean might be slightly elevated by a few outliers at the high end. **Table 18**, below, lists the descriptive statistics for the MMT time sentenced function. Similar data are included for the DTOs for comparison purposes.

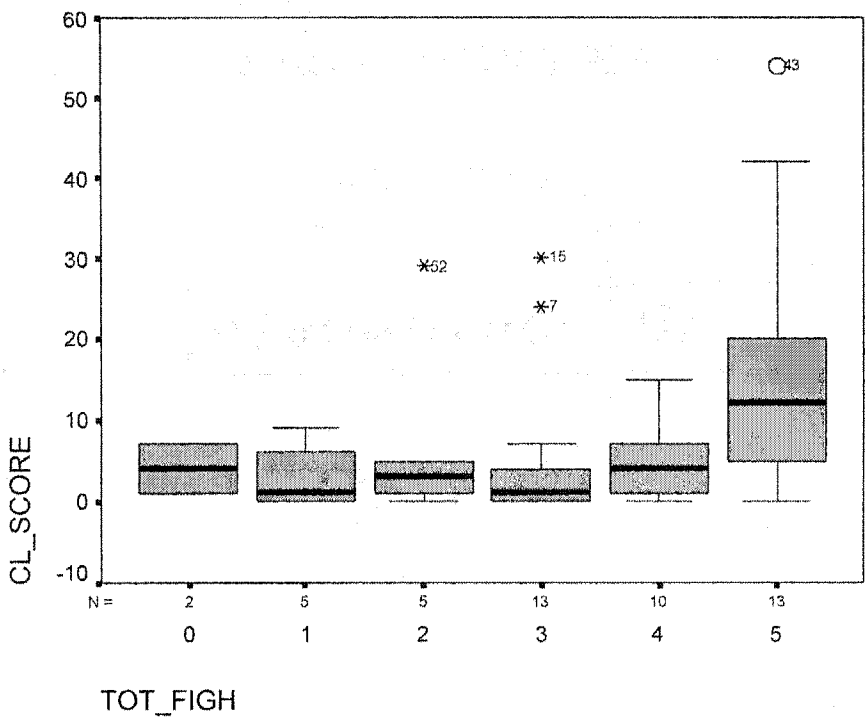
Table 18. Cormier-Lang Score: Descriptive Statistics for the DTO and MMT Groups

Outcome Variable	N	Minimum	Maximum	Mean	Median	Std. Dev.
CL Score DTO	64	0	40	6.31	3.50	8.077
CL Score MMT	50	0	54	8.26	4.50	11.674

Initially, box and wisker plots were examined to determine whether or not a potential difference might exist between any of the predictor variables in terms of CL score. At first glance, it looked as if physical fighting might be a significant predictor of a positive relationship with CL

score. A linear regression also showed a significant correlation (t=2.257, p=.029) between the two variables.

Figure 11. Boxplot Showing a Possible Association between Physical Fighting and Cormier-Lang Score



However, non-parametric tests again needed to be used due to the skewed distribution of the outcome data. The Kruskal-Wallis was used for the seven predictor variables with eight or fewer possible scores. Contrary to the boxplot of physical fighting (shown above) and the linear regression results, the non-parametric test yielded non-significant results. Furthermore, neither stealing, cruelty, fire starting, fearfulness, thrill seeking, nor income were significant predictors of CL score. Next, scatterplots of the continuous variables were examined to determine if and how the two variables were interacting. The figures relating hyperactivity and impulsivity to CL score looked very similar to how they each behaved with the time sentenced function. Both showed only a slight positive relationship to overall offense seriousness. The real story once again lay with the WISC and the antisocial behavior variable. The same negative relationship was apparent on the WISC scatterplot (see **Figure 12** below) and the same non-linear relationship was evident on the antisocial figure (**Figure 13**).

Figure 12. Scatterplot of the WISC and Cormier-Lang Score

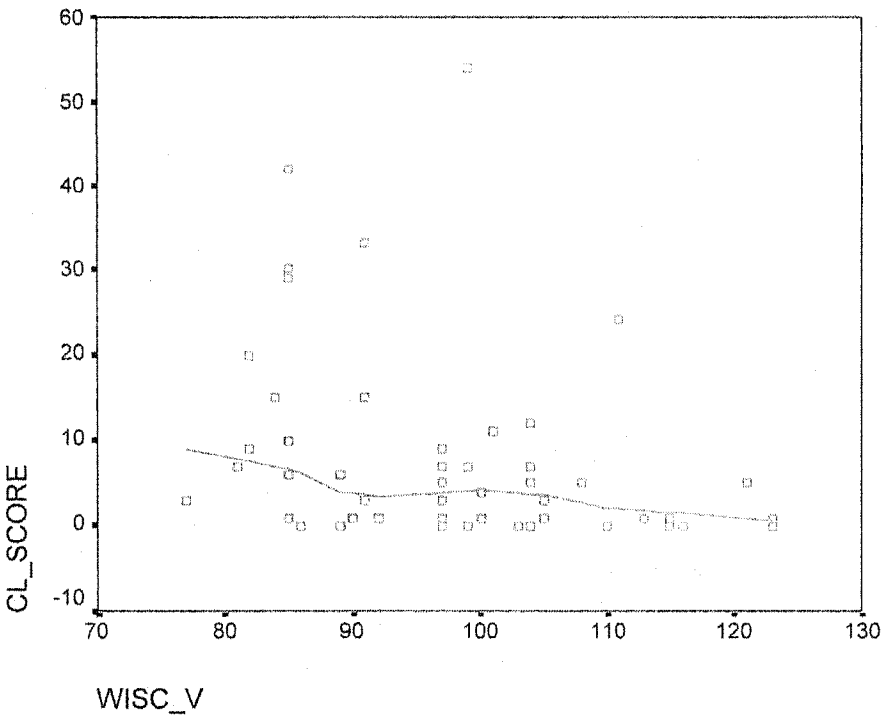
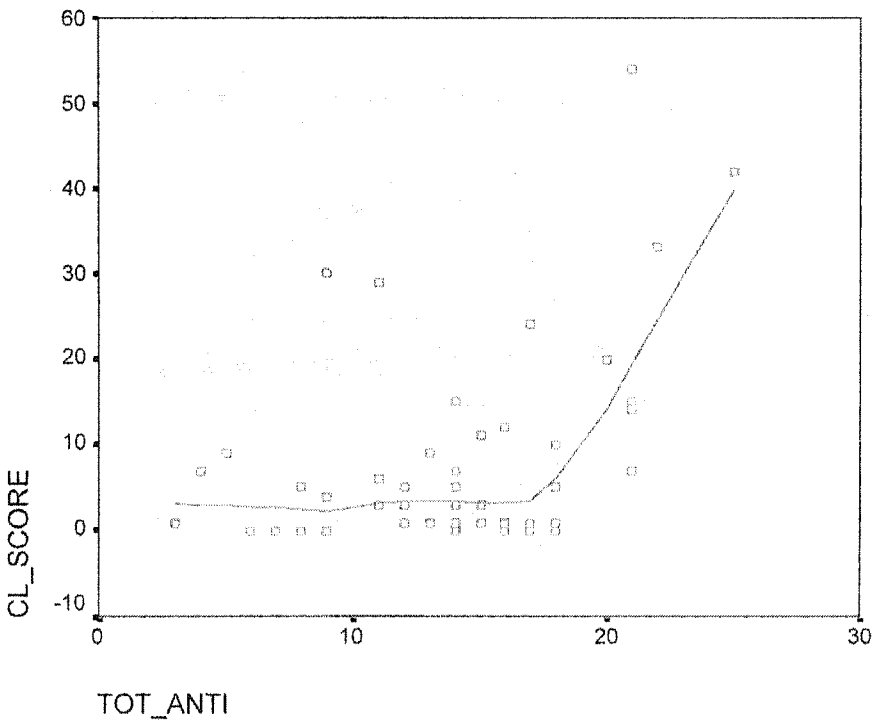


Figure 13. Scatterplot of Antisocial Behavior and Cormier-Lang Score



Once again, a non-parametric test was used to tease out relationships between the predictor variables and CL score. Spearman's rho (ρ) results indicated that all three of the continuous variables (hyperactivity, impulsivity, and antisocial behavior) were significant {ρ (N=46) =.374, p=.010; ρ (N=47) =.360, p=.013; and ρ(N=48) =.340, p=.018 respectively}. A bivariate regression revealed that the WISC was also significant (p=.029), replicating a pattern similar to that shown in the tests of total number of convictions and the time sentenced function. For every -.31 change in CL score, a one-unit increase is expected in the WISC score. The upper and lower confidence intervals are -.032 and -.579 respectively. The percent of variance explained (R^2) is .097, indicating that, although significant, the WISC by itself is relatively weak in terms of predicting CL score. In conclusion, the most consistent finding in the MMT group, using the chronicity logistic regressions, the time sentenced function and the Cormier-Lang system, was that childhood antisocial behavior (particularly) and WISC scores were independently predictive of chronic criminal behavior.

To review, the outcome data for the MMT group was also skewed necessitating the use of non-parametric statistics. In the regression equation distinguishing between offenders and non-offenders, antisocial behavior, impulsivity, physical fighting, stealing, fearfulness, thrill-seeking, and parent's income all significantly predicted criminal outcome. However, the first four predictors were correlated with one another for this participant group, and as such they could all be measuring the same underlying behavior. For the three chronicity regressions, stealing was the only result that was a significant predictor in all three. For the standard using six or more convictions as the cut-off for chronicity, antisocial behavior, stealing, fighting and the WISC were all significant. For the lower standard of five or more convictions, hyperactivity and impulsivity were added to these four significant predictors. Using the most stringent standard of three or more felony convictions and five or more years incarcerated, stealing was the only childhood behavior that could significantly predict participants who met this standard. Results for the time sentenced and Cormier-Lang tests produced similar findings. Hyperactivity, impulsivity, antisocial behavior, and the WISC were all significant predictors, the only difference being that thrill-seeking was also significant in the time sentenced equation. In addition, while the number of chronic

offenders (however defined) was too small to test for whether childhood antisocial behavior and childhood verbal IQ scores had cumulative or interactive effects in predicting chronic criminality, for total convictions it was found that there was an "additive" or cumulative effect in that at any given level of antisocial behavior, higher IQ scores lessened future convictions (and lower IQ scores increased future convictions).

VIII. Discussion

A. Summary of Findings

The goal of this study was to investigate some possible connections between early childhood behavior and chronic adult offending in a population that was at-risk for becoming delinquent. To my knowledge only a few studies have examined in depth the connection between such specific early childhood factors measured contemporaneously and chronic adult offending in a comorbid population, usually due to the constraints imposed by small sample sizes. This data set offered a unique opportunity to relate childhood behavior, socio-economic status and IQ scores of hyperactive children with conduct problems to criminality, especially repeat criminality in adulthood.

The first finding of this research was unforeseen. The DTO group had uniformly higher childhood behavior scores, and yet lower criminality in adulthood than the MMT group. Despite displaying more of all of the problematic childhood behaviors, the DTOs were less likely to engage in criminal activity or become serious, chronic offenders than the MMTs who had lower problematic childhood behavior scores. This was not just true for a majority of the variables. The means for *every* childhood problem behavior was higher (i.e., more detrimental) for the DTOs (and nine of eleven variables reached statistical significance). Yet their propensity to engage in criminal activity in adulthood was lower (though these differences were not statistically significant). Caution should be used when interpreting these results, however, due to the constraints imposed by low statistical power. Regardless, it cannot be said that the DTOs received some treatment during the course of Satterfield's study that the MMTs did not, because in fact the reverse is true. Both groups received similar psychostimulant drug treatment, and it was the MMTs who received the additional behavior modification. Could this additional treatment have had a reverse effect? There is no way to make a determination from the results of this study that did not examine the participants' childhood behaviors post-treatment. It is possible, however, that the differences are due to the cohort effect discussed previously: the DTO subjects were recruited into the study a few years earlier than the MMT subjects and it is possible that, somehow, this caused the differences in child behavior ratings.

Another finding of this study, although it was not directly related to the chronicity issue, was that for both the DTO and MMT groups the participants who became offenders tended to be more impulsive and antisocial and were more likely to be involved in physical fights and theft as children. This finding is almost intuitive; participants who were engaged in antisocial behavior as children were more likely to escalate that behavior as they age. Offenders, *as a group*, however, did not display more hyperactivity than their other ADHD peers. This finding is consistent with one line of research which indicates that hyperactivity alone does not predict criminal behavior within a hyperactive group (Mannuzza, Klein, Bessler, Malloy, 1993; Hechtman, Weiss, Perlman, Amsel, 1984). However, this latter finding, though not noteworthy by itself, is interesting when juxtaposed against other results in this study.

However, the focus of this project was not about what predictive variables differentiate offenders from non-offenders. Rather, this study sought to determine what predictive variables differentiated *chronic* offenders. The following table drastically simplifies the confusing and diverse results involving chronicity, which were presented in the Statistical Results sections, in an attempt to tease out the main findings of this research. It shows only the most commonly occurring results (hyperactivity, antisocial behavior, and WISC). If other variables were significant but excluded from the chart they are represented by a "...".

Table 19. Simplified Listing of Significant Results

Tests of Chronicity	DTO Results	MMT Results
6+ Convictions	Hyperactivity	Antisocial Behavior WISC ...
5+ Convictions	Hyperactivity	Hyperactivity Antisocial Behavior WISC ...
3+ Felony Convictions and 5+ Years in Jail or Prison	None	...
Time Sentenced	Hyperactivity Antisocial Behavior ...	Hyperactivity Antisocial Behavior WISC ...

Table 19 (continued)

Cormier-Lang Score	...	Hyperactivity Antisocial Behavior WISC ...

Thus, the bulk of the results of this study can be reduced to three major conclusions. First, the participants who received the highest ratings of hyperactivity more frequently met a standard for chronic criminality than participants with any other studied childhood behavior across both groups. Results indicated that, in fact, hyperactivity was *not* a predictor of future criminality in general, only of serious, chronic criminality. For the DTO group, hyperactivity was the *only* childhood variable that was a significant predictor in the logistic regressions using two of the three different standards of chronicity (no variables were significant using the third standard). When the offenses were quantified to capture the overall seriousness of the crimes committed (as indicated by the Cormier-Lang score), hyperactivity was again significant in the MMT group – indicating either recidivistic criminality or that these participants were committing a small number of the most serious offenses (i.e., homicide, rape, kidnapping). The most severely hyperactive participants in both the DTO and MMT groups were also more likely to receive more total jail, prison, and probation sentences.[10] The results do *not* indicate that a severely hyperactive child is more likely than not to become a serious, chronic offender. But they do show that the most severely hyperactive children in this study – all of whom had co-morbid conduct problems – were more likely than their less hyperactive (though conduct problemed) peers to exhibit serious, chronic criminal behavior in adulthood.

This was not an expected result. When this methodology was constructed, a rating of hyperactivity was only included to confirm that it was *not* predictive of chronic offending (since the bulk of previous research had found, though not without contradiction, that hyperactivity was not a primary independent pathway to adult offending). However, according to a minority of previous

[10] It might be the case that the hyperactivity variable was also being limited by the ceiling effect. In **Figure 3** on page 39, it looks as though the relationship between hyperactivity and time sentenced is negligible until the final few points on the high end of the hyperactivity scale. Perhaps if this scale had a greater number of possible points the relationship between the most severely hyperactive children and the months to which they were sentenced for their criminal behavior could be more clearly analyzed. It is also worth noting that hyperactivity had the widest range of scores (18-point spread) out of all of the childhood behaviors, and this could have produced the significant result.

studies, amongst a population of comorbid children, it *was* the hyperactivity symptoms, not the conduct problems, that predicted future criminal behavior (Elander, J., Simononff, E., Pickles, A., Holmshaw, J., Rutter, M., 2000; Taylor, E., Chadwick, O., Heptinstall, E., Danckaerts, M., 1996). To our surprise however, the most common result across both groups was that hyperactivity was independently predictive of chronic offending and, as mentioned above, for two tests of chronicity involving the DTO group, hyperactivity was the only significant predictor. Nevertheless, these two tests on the DTO group do not necessarily support the Single Pathway Model discussed in **Section III** of this study as applied to chronic criminality. Amongst the DTO population of comorbid children, it was the degree of ADHD symptoms, not the degree of conduct problems that predicted future chronic criminal behavior. However, since all the participants in the study also exhibited significant conduct problems as children it cannot be said, from this data, that hyperactivity predicts chronic future criminality wholly independently of childhood conduct problems.

All of the participants in this study had antisocial behavior problems. Indeed the mean and median level of antisocial behavior in the DTO group was twenty on a scale from zero to thirty-one. Therefore, it may be the case that hyperactivity predicts chronic adult criminality only amongst individuals who exhibit a certain degree of conduct problems in childhood (which would exemplify the Cumulative Effects or Synergist Models). However, since this study did not include a group which exhibited significant hyperactivity without significant conduct problems in childhood (if such a group exists), these two models could not be tested against one another.

Moreover, to the limited extent that the DTO results support the Single Pathway Model for chronic criminality, they do not represent the overall findings of this study. Aside from the two logistic regression results discussed above, hyperactivity almost always co-occurred with antisocial behavior as a predictor of chronic adult offending. Childhood antisocial behavior was the second most common significant finding. For three of the five tests of chronicity for the MMT group and one of the five tests on the DTO group, hyperactivity and antisocial behavior were both significant predictors even though they were not correlated. Antisocial behavior was never the sole predictor of chronicity using any of the tests. If these overall findings supported the Single

Pathway Model, antisocial behavior should not have predicted chronicity independently from hyperactivity. Instead, the independent predictive power of the two childhood behaviors somewhat support the Different Pathways Model because the key component of ADHD (hyperactivity) and the key component of Conduct Problems (antisocial behavior) most often independently predicted chronicity. Again, however, since all of the participants were comorbid for childhood hyperactivity and conduct problems, the Cumulative Effects Model—and even the Synergistic Model—cannot be excluded from being the most appropriate models.

It should be reiterated that hyperactivity and particularly childhood antisocial behavior, according to our data, predict the degree of chronicity in a non-linear way. This is shown by the hyperactivity and antisocial behavior lowess fit regression lines, which tend to be fairly straight until the highest values of each predictor variable are reached and then the lines make a sudden curve upward. The lines bend and only the extremely hyperactive and antisocial children are producing the extreme criminal outcome scores. This signifies that the relationships between the predictors and the outcome variables are non-linear and that the predictive power lies especially with the small percentage of the most severe childhood behavior scores. The MMT antisocial data illustrates this point. Of the 63 MMT participants, four of the five with the highest antisocial behavior scores (all occurring after the bend in the lowess line) accounted for the top fifteen percent of the time sentenced scores. This indicates that the lower antisocial scores have little ability to predict a participant's likelihood of incarceration, but the prognostic power of childhood antisocial behavior rests with the children who displayed the highest level of antisocial behavior.

The third and final result was only present in the MMT group. A participant's verbal IQ was negatively related to chronicity. In other words, participants who had higher verbal IQs were less likely to become recidivistic criminals. This significant result occurred using four out of the five standards. This finding is consistent with other research showing that low IQ is correlated with future criminality (Raine, 1993). This result however, was not replicated in the DTO group, where the WISC never significantly predicted chronicity no matter which method was used. In sum, regarding the IQ results for the MMT group, lower IQ was an independent predictor of chronicity (in this comorbid group) and, as can be seen from **Figure 9**, for total convictions *only* it

had a cumulative effect with antisocial behavior. (In no case were there a sufficient number of participants with chronic criminal outcomes to test the applicability of the Synergistic Model.)

Do these results support the hypothesis? Yes, in that there seems to be particular childhood attributes and behaviors in this comorbid population that are correlated with chronic offending in adulthood – in this case hyperactivity, antisocial behavior, and low verbal IQ. Were these the expected results? No. At the inception of the study it was anticipated that physical fighting and cruelty would be significant predictors, but these results did not materialize. Although physical fighting was occasionally significant as a predictor it was expected to play a much more central role, and cruelty which was expected to be the defining factor between offending and chronic offending, never reached significance. However, particularly regarding the cruelty variable, these results – or lack thereof – may be a function of the study population, which had very low mean ratings of cruelty, one out of a possible maximum of six for the DTOs and .49 out of a possible maximum of six for the MMTs.

In general, the three main findings of this study are consistent with other research on ADHD/CD children and adult criminality. By itself (inconsistently) or combined with other antisocial behaviors, hyperactivity has been found to be a significant risk factor for future recidivism. One longitudinal study of boys with behavioral or emotional problems and adult criminality found that hyperactivity alone was predictive of chronic offending (five or more convictions) and having been incarcerated, which was not mediated by a childhood diagnosis of CD (Elander et. al., 2000). Another longitudinal study which used self-report measures and official criminal histories found that for the most chronic offenders (those with ten or more self – reported crimes), hyperactivity-impulsivity and conduct problems were both independently predictive, and that children with comorbid ADHD and CD were at an even greater risk for future recidivism (Babinski, Hartsough and Lambert, 1999). These findings are in line with the Farrington, Loeber, Van Kammen (1990) article discussed earlier. Their results indicated that Hyperactivity-Impulsivity-Attention deficit (HIA) and conduct problems were both independently predictive of juvenile convictions and chronic offending, and that for at least for juvenile convictions, HIA and CP had an additive effect. However while the Farrington, et. al. (1990)

study did not control for the fact that their co-morbid group had lower socio-economic class standings than their non-co-morbid groups, in this study no socio-economic class differences were obtained between the extremely hyperactive or antisocial children and the other participants.

There are also a few studies which have been published recently by David Farrington that examine psychosocial risk and protective factors in children and their role in future criminality. One study found that the most important risk factors included having a convicted parent, a large family, low school achievement and/or motivation, and a young mother (Farrington, 2000). Variables with a protective effect included high accountability, trustworthiness, and a good relationship with parents (Stouthamer-Loeber, Loeber, Wei, Farrington, Wikstrom, 2002). Information regarding some of these variables exists in the Satterfield dataset. However, time constraints negated the possibility of studying all of these variables in the current study. Future efforts with this cohort should further explore what role these variables play in the development of serious chronic offending.

Regarding the issue of what pathway model these results support, few firm conclusions can be drawn. Although (lower) verbal IQ scores and childhood antisocial behavior were found to have a cumulative predictive effect for *total* adult convictions, the number of chronic offenders was too small for statistical tests of cumulative effects or interactions and, therefore, those models could not be tested with chronic criminal offending. Also as noted above, since the study cohort all had conduct problems, even in the DTO group, where the degree of childhood antisocial behavior was not consistently an independent predictor of chronic offending, it cannot be said that those problems were irrelevant to later offending. And again, in the MMT group the degree of antisocial behavior *was* an independent predictor. Thus, the best conclusion that can be derived from this research is probably that among children with hyperactivity and conduct problems, a particularly high level of either is a risk factor for chronic criminality in adulthood and this risk can be enhanced by a relatively low verbal IQ score or moderated by an elevated verbal IQ score. But the particular cumulative or interactive (i.e., synergistic) effects of these variables can only be determined with future research using larger samples.

B. Methodological Limitations

One advantage of a prospective, longitudinal research design is that it allows for the examination of the participant's childhood behavior and early experiences, which were collected contemporaneously. This type of design does not rely on retrospective diagnoses or self-reports of behaviors as they manifested themselves 30 years in the past. Thus a prospective design allows for a clearer, more accurate picture of the child's symptoms, his abilities and weaknesses, and any early patterns of antisocial behavior.

However, there are also limitations to this type of methodology. First and foremost, although at least half of the participants had been convicted of a crime, chronic offenders are only a small subset of all offenders, and obviously this was a limiting factor in this study's design. The statistical analyses that were performed yielded meaningful results. However, other statistical tests could not be used due to the small sample size and low statistical power. This hindered our ability to test for cumulative and interactive effects, which is an important element of research on ADHD and CP. This constraint plagues all research on chronic offenders, except studies following enormous numbers of children through adulthood, and the financial cost of this type of research is excessive. In acknowledgement of this limitation, this study was designed to be exploratory in nature and the findings should be interpreted with caution. Research on chronicity is relatively new and these results are only a precursor to future research in this area. These inquiries should further explore the preliminary findings of this study, which indicate that a non-linear relationship might exist between specific childhood behaviors and chronic criminality in adulthood.

The second limitation is inherent in all longitudinal research involving childhood psychological disorders. Changes in the DSM since 1970, when the cohort was first identified, make a diagnosis based on current DSM-IV criteria impossible. Children in the cohort were selected for the study using versions of questionnaires that have since been updated. The majority of the pertinent questions, however, remain the same and the predominant symptoms (impulsivity, hyperactivity, etc.) are still identifiable. In this case, the participant's behavior during childhood was used to predict his adult behavior. This avoided using an ADHD or CD diagnosis

(the criteria of which are susceptible to change) to predict future criminal behavior. This alleviated the problems associated with a shift in DSM nosology over the last thirty years.

Another problem with this study is that participants were not randomly assigned to the DTO or MMT groups but, rather, received their group assignment based on temporal considerations. A reasonable criticism might be that the two groups produced unequal results because of group membership. However, the non-random assignment occurred because MMT, as a treatment modality, was just emerging, and participants enrolled earlier tended to receive the DTO treatment, while those arriving later tended to receive the MMT treatment. Thus, there was a confound of temporal order with treatment modality, but there is no reason to conclude that the MMT group was more in need of treatment, by virtue of the treatment utilized, than the earlier-treated DTO group. Nevertheless, according to the behavioral ratings, the two groups did differ in significant ways; and because the populations represented by the two samples differed in the patterns of covariances between the childhood behavior variables (which were rated *prior* to treatment for ADHD), and this made it impractical to combine the two groups or to use the outcome data of one group to cross-validate the other.

As is always the case with this type of study, there is the possibility that some criminal offenses by the participants went undetected or unreported. However, since all 226 names and birth-dates were run on the same California Department of Justice database, there is no reason to believe that under-reporting (or lack of detection in California) was a confound for some subgroups of the participants but not others. It is always a concern, too, that some races and classes are over-represented by the use of official criminal offense histories. However, an inspection of the approximately twenty-four chronic offenders' races and socio-economic statuses indicated a distribution similar to the rest of the participant population. It was also noted earlier that despite the research team's best efforts, criminal offense histories could only be obtained from the state of California. This created a situation of under-reporting if a participant committed crimes in a state other than California. And there is the possibility of the more severely hyperactive subjects moving frequently and relocating outside of California. This would confound – that is weaken -- the associations between the predictors and the adult criminality variables

found in the data and possibly negatively bias the effect-size estimates. There could also be an association between an offender's low IQ and his propensity for getting caught by the police when he commits a crime. It seems plausible that these subjects could then be over-represented in the offender outcome data, exaggerating the actual association between IQ and criminality.

There is a great deal of new research on the age of onset of aggression and antisocial behavior. Much of it indicates that the earlier the ADHD child displays violent or aggressive behavior (if at all), the higher the likelihood that he will repetitively come in contact with the criminal justice system (Loeber & Farrington, 2000). Moffit & Caspi (2001) suggest that childhood-onset delinquents had more behavior problems (among other troubles) and were more likely to travel along the life-course persistent antisocial behavior pathway than their adolescent-onset peers. Lahey, Waldman, & McBurnett (1999) similarly propose that children who have an earlier onset of antisocial behavior tend to be more physically aggressive versus children with later onset. Teen-agers with adolescent-onset of antisocial behavior tend to desist after a few years of engaging in non-aggressive delinquent behavior, whereas children whose antisocial behavior begins in childhood are more likely to become life-course persistent and engage in more physically violent crimes (Kosterman et. al., 2001). In this study all of the participants exhibited hyperactivity and conduct problems prior to adolescence but no further data were available regarding the precise age of onset of these items. Obviously, future attempts to study chronic criminality need to identify the age of onset of physical aggression, violence, and antisocial behavior as separate predictors.

C. Future Research

As discussed previously, empirical research relating childhood behavior disorders to chronic adult offending is relatively sparse. Beyond this study, there are still many potential avenues of research worthy of investigation. First, there are extensive research opportunities still available with Dr. Satterfield's cohort. There are many potentially predictive psychosocial variables (i.e., characteristics of the family, peer relationships, self-concept) that were not studied in this project due to time constraints. Unfortunately, however, future research on this cohort will similarly be plagued by a low n. This is true to an even greater degree for information regarding

the psychosocial variables because it was only obtained from the parents of participants in the MMT group. However, since the adult criminal history data has already been obtained, it seems worthwhile to do another exploratory study with this cohort involving chronic criminal behavior and the psychosocial variables as predictors. Moreover, juvenile conviction data was also collected for the MMT group, allowing for a design that investigates the child's age at first offense as an additional predictor variable in relation to future criminal behavior. To help ease the statistical constraints imposed by low n, there is also a control group who were asked to complete the same childhood questions and could serve as a comparison group, if needed. Since it is such a lengthy process to compile a dataset such as this one, regardless of its limitations it would be foolhardy to ignore the potential research opportunities that still exist with it.

Second, it would be extremely useful to find another cohort, similar to Dr. Satterfield's, so that the findings from this study could be cross-validated. It would also be interesting to find a cohort large enough to test if and how childhood variables (whether behavioral or psychosocial) interact with each other and affect chronic criminality in adulthood. To cross-validate this study's findings a prospective design would be ideal, despite its time constraints and issues with attrition. However, future studies should examine federal criminal records which report offenses nationwide instead of statewide records, which would reduce the number of subjects that could not be found in adulthood. Similarly, if the subjects consent to being followed up in adulthood, self-report measures could be gathered periodically which could also lessen attrition.

Lastly, future research in this area should attempt to determine what is the best way of defining chronic criminal offending. The current study used five different measures of chronicity. Some were based on standards used in other studies and others were more exploratory in nature. Overall, this research did not point to one specific measure as clearly superior to the others, but instead showed that each standard yielded slightly different results. It is worth noting, however, that the trend in the literature is not to measure chronicity on a continuous scale (in fact, *none* of the other studies discussed in this paper used a continuous measure of chronic adult offending), but instead to create cut-off points on a categorical scale. The continuous measures used in this study (time sentenced and Cormier-Lang) proved to be novel ways to approach the

data. This is not to say that these particular scales were the best measures and yielded the most accurate results, but that future research might also want to consider viewing chronicity as a continuous variable, instead of imposing a variety of somewhat arbitrary cut-offs on the outcome data. Most importantly, however, future research should seek to determine what measure(s) of chronicity *and* severity of criminal behavior best identifies the truly most serious adult offenders so that the precursors of specifically serious and chronic criminal behavior can likewise be best identified through appropriate future research.

D. Contribution to Knowledge

There is an urgent need for a method of identifying, as early as possible, the small group of individuals who will commit multiple, serious offenses. The portion of offenders who are chronic recidivists is small, yet they are committing a disproportionate amount of crime (Wolfgang, Figlio, Selin, 1972; Tracy, Wolfgang, Figlio, 1985). If the childhood precursors to chronic offending can be successfully identified, preventative treatment can begin at a much younger age. The cost of treating a child when they are young is only a fraction of the long-term social cost of confinement once they mature (Satterfield, Satterfield, Cantwell, 1981). Even though the results of this study are mixed and inconclusive – allowing for only a few firm conclusions to be drawn – hopefully this research will help to refine future efforts in the study of the causes of chronic and serious adult criminal offending.

APPENDIX A: State of California Department of Justice Approval

BILL LOCKYER
Attorney General

State of California
DEPARTMENT OF JUSTICE

BUREAU OF CRIMINAL INFORMATION AND ANALYSIS
P.O. BOX 903387
SACRAMENTO, CA 94203-3870
Facsimile: (916) 227-4815
(916) 227-3460

September 14, 2000

Ms. Kathy Faller
226-25B Kingsbury Avenue
Bayside, NY 11364

RE: Research Request RES-00-011

Dear Ms. Faller:

This letter is in response to your request for criminal history for research purposes. I have reviewed your request package and it appears to be in order. Therefore, your College is approved to conduct the criminal history record checks for the purpose of evaluating adults criminal conduct after having been diagnosed with Attention Deficit Hyperactivity Disorder and conduct problems as juveniles. Please have the California Department of Corrections enter RES-00-011 in the route field (RTE/) which will identify for your respective Department of Justice auditor that the inquiry was authorized for research purposes.

As indicated in your request package, be advised to comply with all of the statutes, regulations and policies affecting the proper handling and dissemination of criminal history information.

If you have any questions, please contact Mr. Tony Crittenden at (916) 227-3460.

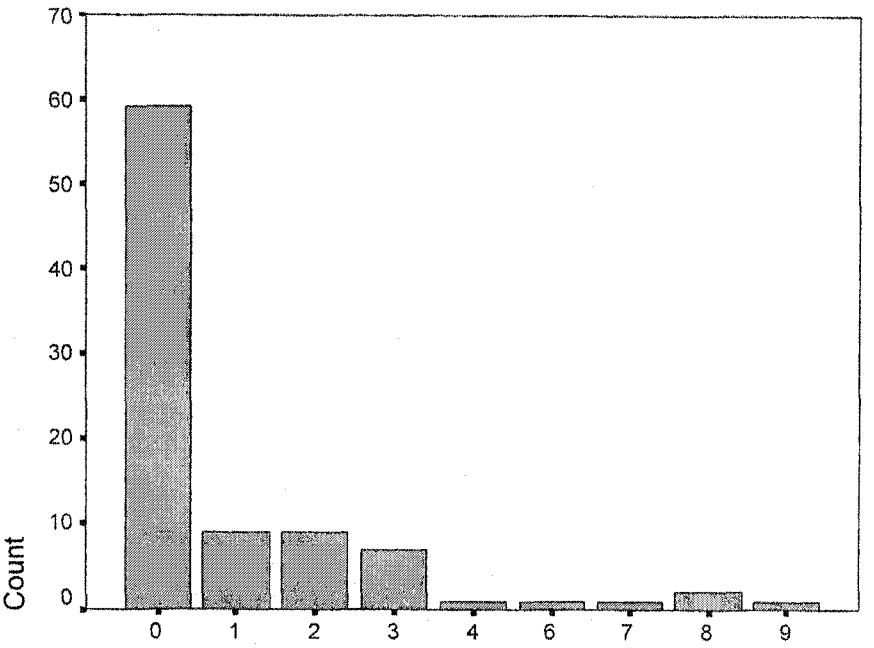
Sincerely,

GEORGE RENFROE, Manager
Communications Administration Program
Bureau of Criminal Information & Analysis

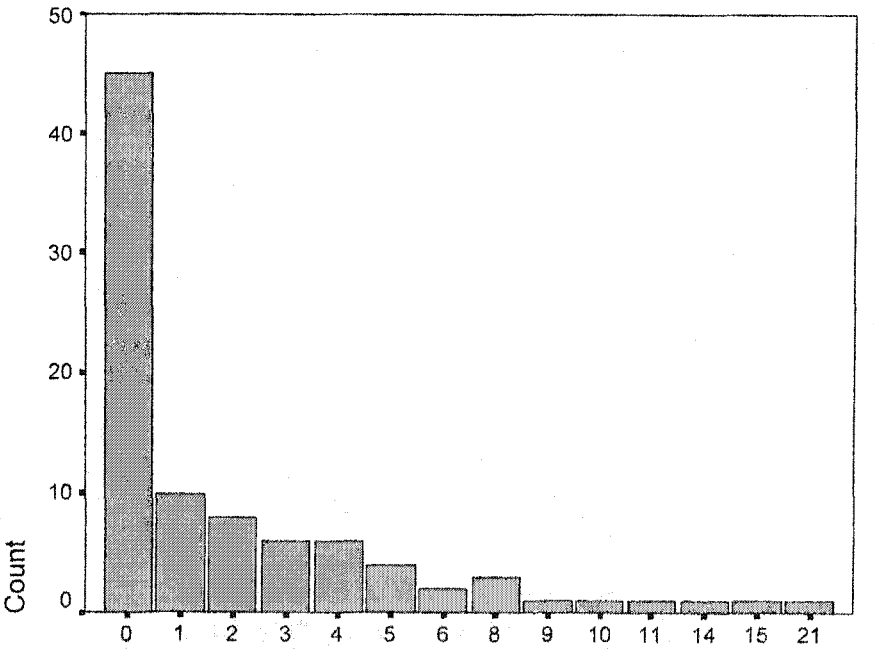
For BILL LOCKYER
Attorney General

APPENDIX B: Ancillary Statistical Information

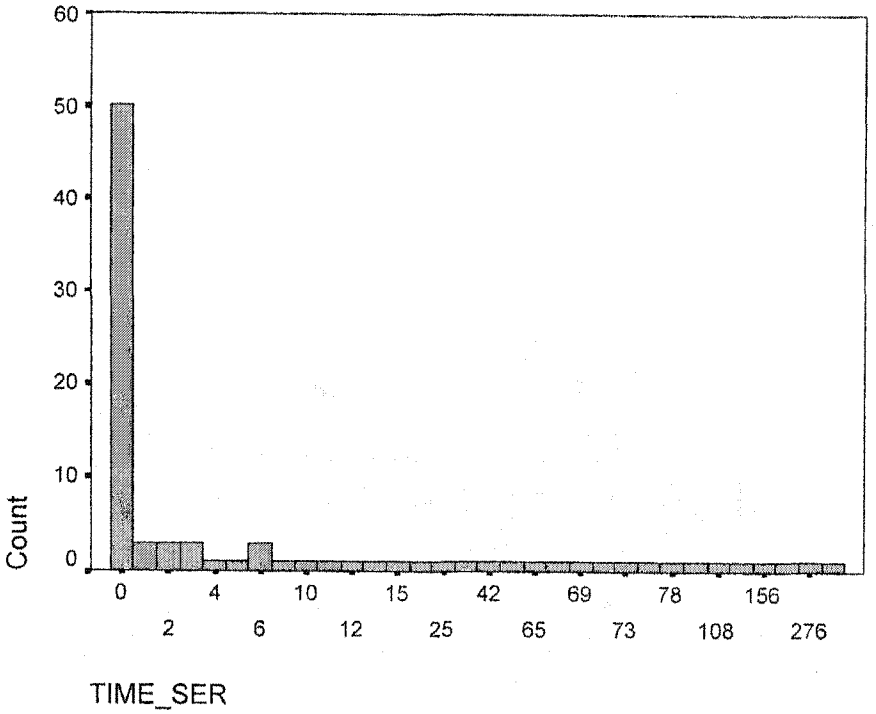
Bar Graph of Number of Participants by Number of Felony Convictions



Bar Graph of Number of Participants by Total Number of Convictions



Bar Graph of Number of Participants by Amount of Time Sentenced



APPENDIX C: The Cormier-Lang System for Quantifying Criminal Involvement

GROUP 1

Homicide (murder, manslaughter, criminal negligence causing death)	28
Attempted murder, causing bodily harm with intent to wound	7
Kidnapping, abduction, and forcible confinement	6
Aggravated assault, choking, administering a noxious thing	6
Assault causing bodily harm	5
Assault with a weapon	3
Assault, assaulting a peace officer	2
Aggravated sexual assault, sexual assault causing bodily harm	15
Sexual assault with weapon	12
Sexual assault, gross indecency (vaginal or anal penetration; victim forced to fellate offender)	10
Sexual assault (attempted rape, indecent assault)	6
Gross indecency (offender fellates or performs cunnilingus on victim)	6
Sexual assault (sexual interference, invitation to sexual touching)	2
Armed robbery (bank, store)	8
Robbery with violence	5
Armed robbery (not a bank or store)	4

GROUP 2

Robbery (bank, store)	7
Robbery (purse snatching)	3
Arson and fire setting (church, house, barn)	5
Arson and fire setting (garbage can)	1
Threatening with a weapon	3
Threatening (uttering threats)	2
Theft over* (includes car theft and possession of stolen property over)	5
Mischief to public or private property over*	5
Break and enter and commit an indictable offense (burglary)	2
Theft under* (includes possession of stolen goods under)	1
Mischief to public or private property under* (includes public mischief)	1
Break and enter (includes breaking and entering with intent to commit an offense)	1
Fraud (extortion, embezzlement)	5
Fraud (forged check, impersonation)	1
Possession of a prohibited or restricted weapon	1
Procuring a person for, or living on the avails of prostitution	1
Trafficking in narcotics	1
Dangerous driving, impaired driving (driving while intoxicated)	1
Obstructing peace officer (including resisting arrest)	1
Causing a disturbance	1
Wearing a disguise with the intent to commit an offense	1

Modified Cormier-Lang System

Group 1	
Homicide	28
Attempted Murder	7
Kidnapping / Car jacking	6
Aggravated assault, battery w/ SBI	6
Assault causing bodily harm, battery, corp inj on spouse	5
Assault with (deadly) weapon	3
Assault, assaulting a peace officer	2
Aggravated sexual assault / Rape by force	15
Sexual assault with a weapon	12
Sexual assault, gross indecency	10
Attempted rape	6
Gross indecency, lewd act w/ minor	6
Sexual interference	2
Armed robbery	6
Robbery with violence	5
Group 2	
Robbery	5
Arson (church, house, barn)	5
Arson (garbage can)	1
Threatening with a weapon	3
Threatening (uttering threats)	2
Grand Theft Property, Grand Theft Auto	5
Take vehicle without consent	4
Breaking and entering, burglary	2
Theft	3
Petty Theft	1
Possesion of stolen goods, receving stolen property, buy prop w/ ID removed	1
Public mischief, vandalism, tampering, damage to prison cell/powerline	1
Prison escape	2
Jail escape	2
Accessory	1
Fighting	1
Enter a non-commercial dwelling	1
Fraud, extortion, embezzlement	5
Fraud, forged check, false ID, forgery, insuficient funds	1
Possesion of a prohibited weapon, carry a concealed weapon	1
Prostitution	1
Trafficking in narcotics, posession of drugs or needle, under influence	1
DUI	1
Hit and Run	2
Obstructing\evading a peace officer, resisting arrest	1
Causing a disturbance, disorderly conduct	1
Wearing a disguise w/ intent to commit an offense	1
Group 3	
Charge not specified	0
Non retainable offense	0
Failure to appear	0
Evading a railroad fare	0
Food stamp violation	0
Contempt of Court	0

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