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Developmental Trajectories of Self-Control: Assessing the Stability Hypothesis

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Developmental Trajectories of Self-Control: Assessing the Stability Hypothesis

By

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DEDICATION

       I dedicate this dissertation to my wife, Phoebe. I could not have done this without her continued financial and moral support. Thank you for being an understanding wife and friend. I also dedicate this to my son, Grant, for whom I am grateful for. I am deeply indebted to both of you and I love you very much. I would also like to thank the rest of my family for their moral support and encouragement throughout my graduate training.

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ABSTRACT

A key proposition of Gottfredson and Hirschi's (1990) self-control theory is the stability hypothesis which suggests that an individual's level of self-control, once established between the ages of 8-10, is stable over the life course. Empirical results from examinations of the stability hypothesis have been mixed. Prior tests of the stability hypothesis have employed aggregate assessment methods (e.g., mean-level and correlational analyses). Such approaches fail to take into account the possibility that individual developmental pathways may differ. This study employs individual longitudinal data over a four year period for 3,249 7th to 10th grade subjects to assess the stability hypothesis using both traditional stability estimation techniques (e.g., ANOVAs and zero-order correlations), as well as heterogeneity assessment methods – semiparametric group-based trajectory modeling (SPGM). Multinomial logistic regression (MLOGIT) of theoretically and empirically relevant risk factors (i.e., parenting, parental criminality, deviant peers, bonds to school) was employed to distinguish between developmental trajectories. SPGM results suggest that self-control is stable for a majority of the sample; however, a sizeable portion of the sample evinced trajectories for which self-control was marked by considerable change. Specifically, 6 unique trajectories in the development of self-control were identified – two groups were identified with high stable trajectories of self-control and four groups were identified that had lower, less stable trajectories of self-control. Additionally, several risk factors

differentiated these groups. The results indicate that those with lower, less stable

trajectories have more deviant peer association, higher rates of parental criminality, less

intense bonds to school, and lower levels of parenting. These results indicate that self

control is not stable nor is it consistent across groups, leading to a rejection of Hirschi

and Gottfredson's explanation.

CHAPTER 1:

INTRODUCTION

Self-control theory is one of the most influential individual-level explanations of crime and delinquency (Pratt & Cullen, 2000). Even those who have been most critical of the theory recognize its contributions (Akers, 1991). Less than nine years after its publication, Gottfredson and Hisrchi's (1990) *A General Theory of Crime*, the book which introduced self-control theory, was one of the most highly cited criminological works (Cohn & Farrington, 1999). Additionally, Hirschi and Gottfredson have been ranked the first and third most cited criminologists, respectively, since 1991 (Cohn & Farrington, 1998), much of which can be attributed to the attention that self-control theory has received.

The major tenet of Gottfredson and Hirschi's (1990) theory states that individual differences in offending are due to an inability (or unwillingness) to refrain from criminal and analogous behaviors. Specifically, individuals who offend are less concerned about the long-term consequences of their actions. In turn, such individuals take advantage of criminal opportunity because it is quick and easy and does not require long-term dedication. Gottfredson and Hirschi refer to this tendency as low self-control and they suggest that it is the sole explanation of criminal behavior. This component of the theory has received extensive attention. In their meta-analysis, Pratt and Cullen (2000) reported significant weighted mean effect sizes for studies examining the relationship between

self-control and antisocial outcomes ranging from .22 - .29; however, they also found the effects of social learning variables to explain significant variance in outcomes while taking into account the effects of self-control. Thus, their findings question the validity of Gottfredson and Hirschi's claims regarding self-control as the sole explanation of crime as well as its explanatory power.

Although less abundant, research has recently begun to focus on other tenets of the theory, such as the measurement, origins, and development of self-control. The overall findings from these studies have been inconsistent regarding support for these different propositions, questioning its validity. Specifically, Gottfredson and Hirschi state that low self-control consists of several behavioral characteristics and that these components tend to manifest within the same individuals, suggesting that self-control is a unidimensional construct. Research examining the unidimensionality of the self-control construct, however, has been inconsistent (e.g., Arneklev, Grasmick, & Bursik, 1999; Arneklev, Grasmick, Tittle, & Bursik, 1993; Grasmick, Tittle, Bursik, & Arneklev, 1993; Tittle, Ward, & Grasmick, 2003). They also clearly state that individuals are not born with self-control and that it must be acquired. They specify parental socialization as the primary source of self-control. Again, research regarding this proposition has been inconsistent. While empirical evidence exists for parenting as an important factor in the development of self-control (see e.g., Perrone, Sullivan, Pratt, & Margaryan, 2004) other institutions have also been found to be important in its development (see e.g., Turner, Piquero, & Pratt, 2005).

Another important proposition of self-control theory and the focus of the current study is the stability hypothesis. Gottfredson and Hirschi imply that self-control is a

stable trait once it becomes set between the ages of 8 – 10. Although they are not clear regarding the nature of the stability of self-control, most researchers have interpreted their claims as being one of relative rather than absolute stability (Mitchell & Mckenzie, 2006; Yun & Walsh, 2010). This means that while there may be some change in self-control, individuals change at the same rate and in the same direction. Thus, once established, individuals maintain their rank-order positioning on the self-control continuum over time within a given cohort.

Testing the stability hypothesis has important implications for both policy and theory such as the continuity in offending debate (Cohen & Vila, 1996; Nagin & Paternoster, 2000). Gottfredson and Hirschi clearly state that offending is not a necessary outcome of low self-control, and that behaviors analogous to offending (i.e., drinking, gambling, and risky sexual behavior) may also be manifestations of low self-control. , finding self-control to be stable would suggest that continuity in offending may be explained by low self-control. Therefore, finding self-control to be stable would lend credence to a population heterogeneity perspective. In contrast, finding that self-control is not stable would suggest that a state dependence explanation of continuity in offending may be more appropriate. More importantly, theoretical propositions about the stability of self-control and associated claims (e.g., age at which self-control is set and socialization agents responsible for its development) would have to be reconsidered if it were found that changes in self-control occurred beyond the age the theory contends it should remain stable. .

The stability of self-control also has important policy implications. Finding that self-control is stable would emphasize the need for interventions that target early

developmental periods. Because Gottfredson and Hirschi claim that self-control is set before adolescence, interventions designed to help foster the development of self-control would need to be implemented prior to that period. In one of the few studies addressing the policy implications of self-control theory, Piquero, Jennings, and Farrington (2010) conducted a meta-analysis assessing the effectiveness of interventions designed to increase self-control among youth. Their findings suggest that interventions can increase self-control and, in turn, reduce offending.

The stability hypothesis has been subject to several recent empirical tests. The conclusions of these studies have been mixed. Some studies have found that self-control is stable over time (Arneklev, Cochran, & Gainey, 1998; Turner & Piquero, 2002), while others have concluded it to be only modestly stable (Burt, Simons, & Simons, 2006; Mitchell & MacKenzie, 2006; Winfree, Taylor, He, & Esbensen, 2006). One limitation of these studies, however, is that they employed non-differentiated stability assessment methods (e.g., mean-level and correlational analyses). Such methods assume that everyone follows the same developmental patterns in self-control and fail to account for the possibility of heterogeneity in developmental patterns within a population.

There are also important policy implications associated with finding unique developmental patterns of self-control. If, contrary to a self-control explanation, differential developmental patterns exist, (i.e., not everyone follows the same developmental trajectory regardless of their level of self-control or the relative stability of social control), then this opens the search for the causes and correlates of developmental patterns. Identifying factors associated with developmental patters in self-control may

aid in developing policies and programs designed to promote self-control by identifying those life domains that may be the most effective targets for such interventions.

Despite its importance, few studies have directly examined if individuals follow unique self control developmental trajectories; however, indirect evidence provides support for their existence. For example, research on personality development has found that not everyone follows normative patterns in the development of antisocial personality traits (Blonigen, 2010). Studies that have identified unique trajectories in offending provide indirect support for similar trajectories in the development of self-control (e.g., Blokland & Nieuwbeerta, 2005; Chung, Hawkins, Gilchrist, Hill, & Nagin, 2002; D'Unger, Land, McCall, & Nagin, 1998; Fergusson, Horwood, & Nagin, 2000; Laub, Nagin, & Sampson, 1998; Nagin, Farrington, & Moffitt, 1995; Nagin & Land, 1993)Only two studies directly examine if individuals follow different patterns in the development of self-control (Hay & Forrest, 2006; Higgins, Jennings, Tewksbury, & Gibson, 2009). Both studies indicate the existence of distinct developmental trajectories in self-control. However, neither study examined whether potential risk factors distinguish between self control trajectories.

The current study attempts to replicate the findings of the prior two studies that have examined trajectories of self-control (Hay & Forrest, 2006; Higgins et al., 2009) and also attempts to expand upon these studies by examining if certain factors distinguish development trajectory groups identified. Given that only two studies have examined whether there are different trajectories of self-control, it is important replicate those findings. If similar results are obtained in the current study, it would suggest the general theory requires modification to account for them. The assessment of risk factors, if

groups are found, will be an important addition to the existing literature. Specifically, if risk factors are found that can distinguish between trajectories, then this too would suggest the general theory is in need of substantial modification. In order to achieve these goals, the current study employs a semi-parametric group-based modeling approach specifically designed to account for the identification of groups that follow distinct developmental patterns in behaviors or traits (Land, McCall, & Nagin, 1996; Nagin, 1999). The results from this analysis will be compared to methods assessing stability using more traditional methods, including stability coefficients and mean-level analyses. The current study will also examine whether certain risk and protective factors (i.e., parenting style, parental criminality, delinquent peer associations and school socialization) distinguish developmental trajectories in self-control if these difference are discovered. The methodology used in the current study to model developmental trajectories is ideal for such an analysis, allowing for groups with distinct development patterns to be identified and then examining if risk and protective factors differ across these groups.

In the following chapters the current study is described in more detail. Before doing so, the theoretical background and empirical literature are presented. In chapter two, the major propositions of Gottfredson and Hirschi's theory are presented. First, the concept of self-control as defined in the theory is described mainly with regards to its composition. Second, the theoretical claims regarding the relationship between low self-control and antisocial behavior are presented. Third, the theoretical proposition regarding the acquisition of self-control (i.e., the development of self-control) is examined. Finally, Gottfredson & Hirschi's claim that self-control is a stable trait is discussed.

In chapter three, the empirical status of each of these major propositions is reviewed. First, the literature examining the construct validity of self-control is reviewed focusing on its structure and dimensionality. Second, a review of the extensive body of research examining the association between self-control and crime is presented. Third, research examining Gottfredson and Hirschi's claims regarding the development of self-control is reviewed with a specific focus on studies that assess parenting as the sole contributor and also those that assess the contribution of other social institutions. Finally, the literature testing the stability of self-control is presented by first discussing those studies that use more traditional methods, followed by a discussion of those that employ methods that account for heterogeneity in developmental patterns. Also, research on personality development and offending trajectories is presented as indirect evidence for the identification of distinct development trajectories in self-control.

Chapter four presents the current study and its ability to address gaps and limitations of previous research in this area. In order to do this, a detailed description of the methodology used in the current study is presented. Specifically, this section describes the data collection procedures, the characteristics of the sample obtained in the current study, the measures used to operationalize constructs included in the analyses, and the analytic procedures employed in the current study to identify groups with unique developmental patterns of self-control and the effect of associated risk/protective factors.

Chapter five presents the results from these analyses. This includes a review of the major findings and how they fit with existing research, as well as the limitations of the current study. Also, the implications relevant to both theory and policy will be

discussed, along with suggestions for future research examining the stability of self-

control.

CHAPTER 2:

BACKGROUND ON SELF-CONTROL THEORY

Theoretical Propositions of Self-Control Theory

The main component of Gottfredson and Hirschi's theory is the concept of self-control and its relationship to crime. According to the theory, low self-control is an underlying tendency behind antisocial behavior (also see, Thaler & Shefrin, 1981 for an economic model of self-control). Broadly speaking, low self-control refers to an inability to refrain from engaging in acts that provide immediate pleasure with little concern for long-term consequences. In contrast, individuals with self-control are more likely to refrain from certain precarious opportunities and value the pursuit of long-term goals through conventional means. Based on this definition, Gottfredson and Hirschi distinguish the concept of criminality, which assumes that some individuals have a natural proclivity toward crime, from their concept of propensity or low self-control, which only suggests a propensity to disregard the long-term consequences of certain behaviors.

Gottfredson and Hirschi begin by identifying characteristics common to all forms of crime. They discuss six elements of crime that are consistent with their concept of low self-control. Specifically, they describe crime as being opportunistic, easy, physical, exciting/thrilling, immediately gratifying with little long-term benefits, and injurious. In turn, they suggest that those who are attracted to crime would be characterized by traits

consistent with or complimentary to those elements of crime. In doing so they suggest that those who engage in crime are likely to be: (1) impulsive; (2) have a preference for easy tasks; (3) to be more physically oriented as opposed to mental activities; (4) risk-seeking; (5) quick-tempered, and (6) insensitive. They suggest that these six elements tend to coalesce within the same individuals. Thus, it is implied that the simultaneous existence of all these traits are required for the formation of low self-control and that this intersection of traits will more strongly predict antisocial behavior than any one of its lone components.

While self-control is considered by Gottfredson and Hirschi as the most important variable in explaining criminal behavior, they also discuss the role of criminal opportunity. Gottfredson and Hirschi see crime as occurring when there is an intersection between low self-control and opportunity, with those low on self-control more likely to take advantage of criminal opportunities compared to those with high self-control. However, Gottfredson and Hirschi favor a social selection perspective and suggest that opportunity will only increase rates of offending for individuals with low self-control because they also have a tendency to engage in activities, reside in areas, and opt to hang-out where such opportunities are more prevalent compared to individuals with high self-control. Alternatively, however, a social causation model would suggest these are not selection effects, but rather genuine influences on behavior. Thus, while Gottfredson and Hirschi acknowledge that opportunity is a necessary condition of offending, they also indicate that such opportunities are ubiquitous. Therefore, opportunity should exert little, if any, influence relative to self-control.

Given the traits characteristic of self-control, it is logical to expect that individuals with low self-control also engage in a wide variety of behaviors analogous to crime, and are more likely to be victims of crime, suffer from health problems, and experience unemployment. Therefore, crime is not the only, nor is it a necessary outcome of low self-control but may also include gambling, risky driving, and precarious sexual behaviors among other hazardous behaviors. Because low self-control is seen as the common factor present among all types of crime and analogous behaviors, self-control theory is the quintessential attempt to develop a general explanation of crime and deviance.

Gottfredson and Hirschi clearly state the sources of self-control. Akin to control theories, self-control theory implies that all individuals are born with hedonistic tendencies and engage in self-serving behaviors (alternatively see Kilpinen, 1999; Mansbridge, 1990; Miller, 1999; Sen, 1977; Veblen, 1898). As a result, criminal propensity (i.e. low self-control) is not something that is gained or acquired, but rather is inhibited. The theory, therefore, implies that all individuals are born lacking in self-control and in order for them to become respectful, law abiding citizens they must develop self-control through effective socialization. More specifically, parenting is implicated as the sole socializing agent responsible for the development of self-control.

Gottfredson and Hirschi outline the components of parenting essential for the development of self-control. After a review of the empirical literature on parental behaviors found to be consistently important in preventing deviant and criminal behaviors, they identify three specific components of parenting that are important in the development of self-control. First, they state that parents must monitor or supervise their

children in order to bear witness when antisocial behavior occurs. Second, parents must be capable of recognizing certain behaviors as deviant or antisocial. And finally, parents must be willing and able to apply consistent and fair punishment when that behavior occurs. All three of these aspects of parenting must occur on a consistent basis for the proper development of self-control. Self-control will not be instilled if one or more of these aspects of parenting are missing or inconsistently delivered.

Gottfredson and Hirschi address the idea that parental attachment is an important component of parenting necessary for the development of self-control. Specifically, they suggest that attachment is necessary for the implementation of the other three components of parenting (i.e., monitoring, recognition, discipline). Parents who are attached to their children will monitor, supervise, and discipline their children because they are invested in their children. Parents who are not attached to their child are unconcerned about the whereabouts, associations, and behaviors of their children and, in turn, will not effectively monitor or discipline them. Thus, in the eyes of Gottfredson and Hirschi, the parent-child attachment does not need to be reflected in measures attempting to capture parenting since it can be assumed when effective monitoring, recognition, and discipline are present.

For the most part, Gottfredson and Hirschi dismiss alternative sources of socialization as being important to the development of self-control. Originally, they suggested that schooling could effectively socialize children and facilitate the development of self-control; however, they quickly dismissed this notion on the grounds that poor parenting would undermine the socialization that children experience at school. Essentially, they suggest that schools could only act to supplement parenting in the

development of self-control and is not solely responsible for its development. More recently, however, they have suggested that the school acts more independently in the development of self-control and imply that the school may actually compensate for poor parenting (Gottfredson & Hirschi, 2003). Thus, even though they state that parental behavior is the primary determinant of self-control, they acknowledge other possible sources might exist.

Gottfredson and Hirschi also dismiss biological or genetic factors as possible determinants of one's level of self-control. Because they suggest that everyone is born lacking self-control and it can only be developed through proper parenting practices, they also imply that one's level of self-control is not determined before birth or that defects existing at birth contribute to one's development of self-control. From Gottfredson and Hirschi's standpoint, the common finding that criminal parents produce crime prone children is not due to the intergenerational transmission of criminal tendencies (e.g., genetic or learned). Instead, they attribute this to the idea that parents who are criminal are also low in self-control themselves. Parents with low self-control will also practice poor parenting and ultimately produce children who are low in self-control.

Once self-control is set near the end of childhood, socializing agents, even parenting, are ineffective in altering one's level of self-control. Even though empirical evidence exists marking the effectiveness of policies and treatment programs targeted at reducing antisocial behavior (see e.g., Lipsey, 1992, 1999), such interventions are not effective means of actually altering criminal propensity (i.e., low self-control). Accordingly, Gottfredson and Hirschi dismiss the idea that self-control can be lost or that criminal propensity can be acquired as individuals age. For example, criminal propensity

is unaffected by the association with delinquent peers during adolescence – like-minded youth associate with one another and those low on self-control associate with others who are low in self-control (see e.g., Akers, 1991). Because self-control is determined prior to adolescence and the emergence of peer groups, self-control determines peer group formation and not the other way around. Therefore, Gottfredson and Hirschi see social factors that are said to be associated with crime, such as poor school attendance, deviant peer association, and drug use, as spurious since they are caused by low self-control. Even parenting is said to have only an indirect affect on offending through its effect on the development of self-control and, even then, losing its importance once self-control becomes set. Thus, beyond childhood, self-control becomes an immutable trait that is unaffected by the influences of positive or negative socialization according to the theory.

Since self-control becomes set near the end of childhood and is unaffected by socializing agents beyond this point, it is seen as a stable and enduring trait. Those who are low on self-control will remain low on self-control over the life-course. Accordingly, the same individuals who are low on self-control will continue to be those most likely to engage in crime. Therefore, Gottfredson and Hirschi dismiss any causal relationship between prior and subsequent criminal involvement. The reason why the same individuals continue to engage in crime is because they pervasively lack self-control throughout their life, not because crime increases the chances of subsequent crime.

Although Gottfredson and Hirschi state that one's level of self-control remains stable, they do acknowledge normative declines found in offending that occur into adulthood and suggest that they are not necessarily reflecting increases in levels of self-control. They suggest that as individuals move into adulthood opportunities for

"expressing" a lack of self-control differ from those in previous developmental periods.

For example, truancy becomes failure to maintain steady employment; poor performance

in school becomes poor work history; and risky driving becomes gambling. While some

of these acts may still be considered illegal, they are less likely to be detected. Because

crime is not a necessary outcome of low self-control, explicit illegal acts committed in

adolescence are replaced by other, non-criminal, or at least more covert forms of illegal

behaviors (e.g., drinking, gambling, and risky sex) in adulthood. Therefore, according to

self-control theory, it is not actually offending that is stable, but the propensity to do so.

Moreover, according to Gottfredson and Hirschi, declines in offending do not reflect

increases in self-control.

  While Gottfredson and Hirschi clearly suggest that self-control is a stable trait,

they are less clear regarding the nature of this stability. When referring to the stability of

traits, many times a distinction is made between relative and absolute stability (see e.g.,

Caspi, Roberts, & Shiner, 2005). On the one hand, absolute stability suggests that levels

of some trait remain constant and that no within-individual change occurs over time.

Relative stability, on the other hand, refers to the notion that between-individual

differences on some trait within a single cohort remain constant over time. While

normative changes may be occurring, they occur at the same rate and in the same

direction for all individuals, maintaining the rank-order within that cohort over time.

Thus, absolute stability also assumes relative stability, but relative stability can occur

without absolute stability.

  It is unclear whether Gottfredson and Hirschi's stability hypothesis is one of

absolute or relative stability. However, a close examination of their theory justifies the

common interpretation that it is one of relative stability (e.g., Mitchell & Mackenzie, 2006; Turner & Piquero, 2002). For example, in their theory they state: "As people with low self-control age, they tend less and less to commit crimes; this decline is probably not entirely due to increasing self-control, but to age as well." Inconsistent with other claims about the likelihood of changes in self-control and its relationship to offending (i.e., crime is replaced with other types of behaviors), it seems they do suggest that changes in self-control may occur and that these changes may contribute, at least somewhat, to normative declines in offending. Elsewhere, they disregard the possibility of decreases in self-control and attribute increases in self-control to socialization that continues to occur into adulthood:

> Combining little or no movement from high self-control to low
> self-control with the fact that *socialization continues to occur*
> *throughout life* produces the conclusion that the proportion of the
> population in the potential offender pool should tend to decline as
> the cohort ages (Gottfredson & Hirschi, 1990, pg 107, emphasis
> added).

Based on these statements, it appears that Gottfredson and Hirschi hypothesize that self-control is a "relatively" stable trait and that normative increases in self-control occur for the entire population, yet individuals experience these increases at the same rate. Those who originally had the lowest levels self-control will always be lower in self-control compared to others of the same age and, therefore, will always be more prone to crime.

In sum, there are four major propositions that stem from Gottfredson and Hirschi's theory. First, they see self-control as being a unidimensional construct

comprised of six components (i.e., impulsiveness, preference for simple tasks over complex, more physical as opposed to mental, risk-seeking, quick-tempered, and insensitive). Second, self-control is able to explain all types of criminal and deviant behavior above and beyond other criminological variables. Third, three specific aspects of parenting (i.e., monitoring, supervision, and punishment) are the sole source of self-control up to ages 8 to 10. Finally, once set, one's level of self-control will remain stable across the life-course. The strong claims made by Gottfredson and Hirschi regarding their theory and their competing approach with other theoretical perspectives have led to each these four propositions being subjected to extensive empirical scrutiny.

Literature Review: The Empirical Status of Self-Control Theory

The dimensionality of the self-control construct. Since its conception, there has been a considerable amount of research regarding the structure (i.e., dimensionality) of self-control (Hirschi & Gottfredson, 1993); however, research in this area has sparked considerable debate and little consensus has emerged regarding the nature of self-control (Longshore, Turner, & Stein, 1996; Piquero & Rosay, 1998). Contributing to this lack of consensus is that interpretations of Gottfredson and Hirschi's (1990) definition of self-control have been less than consistent (see e.g., Marcus, 2004). Some researchers interpret their definition as suggesting that self-control is unidimensional (e.g., Longshore al., 1996; Piquero & Rosay, 1998), while others suggest that they describe self-control is a multidimensional construct made up of several distinct traits (e.g., Arneklev, Grasmick, & Bursik, 1999; Vazsonyi, Pickering, Junger, & Hessing, 2001). Thus, it is not surprising that research examining the dimensionality of self-control is somewhat inconclusive.

In general, research has approached examining the dimensionality of self-control in two ways: examination of the definitional (internal) validity of self-control and examining the predictive (external/criterion) validity of self-control. The definitional validity of self-control has typically been examined through the use of factor analysis. Factor analytic approaches can address questions related to the internal structure of self-control as captured by a specific measure. While related, predictive validity addresses the extent to which self-control and its separate components are related to those behaviors that it proposes to explain.

Grasmick, Tittle, Bursik, and Arneklev (1993) developed one of the most widely used measures of self-control. This measure, often referred to as the Grasmick scale, has been the subject of most of the research on the dimensionality of self-control. They created 24 items each of which was designed to be a valid indicator of one of the six elements of self-control as described by Gottfredson and Hirschi. After administering their measure to a sample of university students, Grasmick and colleagues conducted an exploratory factor analysis of all twenty-four items and found that their measure represented a one factor solution. Their findings were replicated by Nagin and Paternoster (1993), Piquero and Tibbetts (1996), and Wood, Pfefferbaum, & Arneklev (1993), who also administered the Grasmick scale to samples of university students and found evidence for a one-factor solution using exploratory factor analysis. After factor analyzing the Grasmick scale, Piquero and Rosay (1998) extended the evidence for self-control as a unidimensional construct among an offending sample.

Alternatively, studies have also found support for a multidimensional structure of self-control also using the Grasmick scale. For example, both Cochran et al., (1998) and

Arneklev et al. (1999) found self-control to be multidimensional with six lower-order factors that all load on one higher-order factor (i.e., "self-control") among a sample of undergraduates. Similarly, Longshore et al. (1996), using the same data as Piquero and Rosay (1998), yet taking a slightly different approach (e.g., inclusion of correlated error terms, modification of response sets from 4 to 5 options), also found that self-control is multidimensional, with subscales that load on a single factor. Vazsonyi et al. (2001) also found evidence for six lower-order factors that load on one higher-order factor of self-control and found this factor structure to be tenable across samples from different nations. DeLisi, Hochstetler, and Murphy (2003) also found support for the hierarchical structure of self-control (i.e., six lower-order factors and one higher-order factor) as measured by the Grasmick scale. In addition, Piquero, MacIntosh, and Hickman (2000) found support for a hierarchical factor structure through the use of an item response theory Rasch model. While the findings from these studies suggest that self-control is multidimensional with lower-order subscales, they still find that they converge on one higher-order factor. Thus, they support the notion that these characteristics tend to manifest within the same individuals.

With regards to predictive validity, Longshore et al. (1996) found that a composite self-control scale was just as or even less predictive of crime compared to some of the identified subscales (e.g., risk-seeking and impulsiveness/self-centered scales). Piquero and Rosay (1998) confirmed these findings, revealing that the risk-seeking and impulsive subscales predicted offending just as well or better than the composite self-control scale. Similarly, Wood et al. (1993) found that the subscales of the Grasmick scale had differential associations with antisocial outcomes. Particularly,

the temper scale was the best predictor of antisocial behavior compared to other subscales. DeLisi et al. (2003) found the temper subscale to be the only significant predictor of delinquency suggesting, again, that self-control is no better an explanatory variable than existing concepts. Alternatively, Vazsonyi et al. (2001) found that each of the subscales had differential associations with different forms of antisocial behavior; however, the total self-control scale proved to be the best predictor of antisocial behavior. With the exception of one study (Vazsonyi et al., 2001), these findings suggest that self-control may not have explanatory power beyond that of existing concepts within criminological theory.

In sum, research tends to suggest that the six traits identified by Gottfredson and Hirschi coalesce in the same individuals. However, it is unclear whether the structure of self-control is unidimensional or if it is characterized by a hierarchical structure. More concerning, however, is the fact that studies examining the relative importance of each components of self-control, as well as the global trait of self-control, tend to suggest that they have differential explanatory power. These findings question the unique predictive ability of self-control beyond traits already identified as important predictors of antisocial behavior (e.g., risk-seeking, impulsivity, or anger).

Research examining the outcomes of low self-control. The empirical status of the relationship between self-control and antisocial behavior is presented in a meta-analysis conducted by Pratt and Cullen (2000). They empirically examined the explanatory power of low self-control based on findings from studies published within the first decade the theory was introduced. Specifically, they examined the results of 21 empirical studies, which contained 126 effect size estimates, representing the integration

of 49,727 individual cases. The results indicated that the effect sizes of the relationship between self-control and antisocial outcomes ranged from .22 to .29. They also conducted moderator analyses in an effort to explore what factors might influence the relationship between self-control and offending. The moderators in their analyses included the effects of attitudinal versus behavioral measures of self-control; longitudinal versus cross-sectional research designs; including competing variables (e.g., social learning and strain); controlling for opportunity; explaining crime versus analogous behaviors; and using samples with different characteristics (e.g., gender, community, juveniles). Contrary to Gottfredson and Hirschi's claims, it was found that the relationship between self-control and crime was not as strong when examined using longitudinal research designs as compared to cross-sectional designs. It was also found that social learning variables remained significant predictors of crime in studies including variables from both theories. These set of findings are not consistent with the theory.

Despite the salience of Pratt and Cullen's (2000) meta-analysis as a marker for the empirical status of the theory, another decade of research on self-control has elapsed. During this time a number of notable studies have examined the association between low self-control and various types of antisocial behavior using a variety of methodological approaches. Studies have examined the association between self-control and official reports of offending. DeLisi (2001) found low self-control to be a correlate of a variety of index offenses based on arrest records, including violent, property, white collar, and nuisance offenses (e.g., prostitution and disorderly conduct). Junger, West, and Timman (2001) found that individuals who engaged in risky driving behavior, which they used as a behavioral indicator of low self-control, were more than twice as likely to have an

officially recorded arrest within the last five years compared to those who have not engaged in risky driving behavior. While these studies found support for the relationship between low self-control and official offending, they were both based on cross-sectional data.

A larger number of studies have examined the relationship between self-control and various types of self-reported offending. Tittle, Ward, and Grasmick (2003) found that both a behavioral and attitudinal measure of low self-control to be associated with various types of self-reported illegal (e.g., theft and assault) and analogous (e.g., gambling) behaviors. Holtfreter, Reisig, Piquero, and Piquero (2010) also found that low self-control was significantly related to self-reported offending, analogous behaviors (e.g., academic dishonesty), and victimization. Kerley, Hochstetler, and Copes (2009) found an association between low self-control and both self-reported prison infractions and self-reported victimization in prison among a sample of incarcerated offenders.

While some of these studies have examined the association between low self-control and analogous behaviors (e.g., academic dishonesty and gambling), others have found an association between low self-control and specific types of behaviors. For example, Gibson and Wright (2001) examined the association between low self-control and occupational delinquency. Occupational delinquency was defined as antisocial behavior occurring as part of work (e.g., stealing from employers, giving away employers' goods). They found that low self-control interacted with coworker delinquency to have a significant effect on occupational delinquency. However, the direct effect of low self-control on occupational delinquency was not significant once other theoretically relevant variables were included in the model. More importantly, the

direct effect of coworker delinquency remained significant and its effect was stronger than the interaction between co-worker delinquency and self-control. Unnever and Cornell (2003) found a relationship between low self-control and bullying; however, they did not find low self-control to be associated with being a victim of bullying. Higgins and colleagues have conducted several studies examining the association between low self-control and media piracy (e.g., software and movies; Higgins, 2005; Higgins, Fell, & Wilson, 2007; Higgins & Makin, 2004). In all three studies low self-control was found to have a significant effect on piracy; however, all three studies also showed that the association between low self-control and piracy was higher for those who associate with peers who pirate media. Finally, Cochran, Aleska, and Chamlin (2006) found low self-control to be related to self-reported academic dishonesty.

Other studies have attempted to examine the relationship between self-control and antisocial behavior using longitudinal data. Some studies have looked at this longitudinal relationship using officially recorded offending. Langton (2006) found that low self-control assessed at baseline predicted parole violations during a two-year follow-up period among a sample of youth released from secure juvenile detention facilities. Similarly, Piquero, MacDonald, Dobrin, Daigle, and Cullen (2005) examined the ability of self-control to predict violent offending and homicide victimization based on official records of youth released from secure detention facilities. They found that low self-control measured prior to institutionalization was a significant predictor of both violent offending and homicide victimization during a five-year follow-up period. Piquero, Moffitt, and Wright (2007) examined whether self-control measured at several time points across childhood and through adolescence (i.e., ages 3 – 18) was predictive of

delinquent and criminal convictions assessed in early adolescence (i.e., ages 13 – 17) and adulthood (i.e., ages 18 – 26) using official court data. Based on these data, they derived four outcomes of offending including participation (i.e., having a conviction or not), frequency (i.e., number of convictions), persistence (i.e., 2 or more convictions by age 26), and desistence (i.e., having one juvenile but no adult convictions) and found low self-control to be a predictor of all outcomes. Consistent with the work of Pratt and Cullen (2000), and inconsistent with Gottfredson and Hirschi's (1990) suggestion, the findings indicate that the relationship between self-control and offending using longitudinal designs are not as strong as those found in cross-sectional research.

Other studies have examined the relationship between self-control and self-reported antisocial behavior. Cretacci (2008) found low self-control to be a predictor of self-reported property and drug offending over two waves of data collection while accounting for the effects of other theoretically relevant constructs (e.g., rational choice, bonding, and learning); however, low self-control was unrelated to violent criminal outcomes. Smith (2004) found that low self-control assessed at the beginning of the semester among a group of university students had a significant effect on academic dishonesty later in the semester. De Kemp et al. (2009) found that prior levels of self-control exerted a significant effect on both self-reported aggression and delinquency. They also found that the relationship between self-control and delinquency was reciprocal for boys, suggesting that engaging in delinquency contributes to a decrease in self-control and subsequently leads to more offending.

Other studies using longitudinal designs have examined both the direct and indirect effects of self-control on self-reported behaviors. Longshore, Chang, Hsieh, and

Messina (2004), for example, conducted a longitudinal analysis examining the relationship between low self-control, social bonds, delinquent peer association, and drug use. They found that low self-control had a negative association with all four social bonds (i.e., attachment, belief, commitment, and involvement) and deviant peer association; however, its effect on self-reported delinquency was mediated by belief and deviant peer association. Alternatively, Chapple (2005) conducted a longitudinal analysis and found that low self-control had both a direct and indirect effect on self-reported delinquency through deviant peer association. Similarly, Mason and Windle's (2002) longitudinal analysis examining the effects of low self-control on delinquency found that low self-control had both a direct and indirect (through informal social control) effect on subsequent delinquency.

Several studies have also observed similar associations between low self-control and self-reported behaviors among samples from different nations. Seipler and Eifler (2010) found that low self-control had an association with self-reported offending among a sample of German adults. Baron (2003) found that low self-control was associated with self-reported offending (i.e., property, violent, and drug offenses) among a sample of Canadian youth. It was also found that individuals with low self-control were somewhat more likely to associate with deviant peers, hold deviant values, be homeless, and be unemployed compared to those with high self-control. Ribeaud and Eisner (2006) found that low self-control predicted self-reported delinquency and drug use among a sample of Swiss youth. They also found that low self-control accounted for some of the association between drug-use and crime. Ozbay and Koksoy (2008) found low self-control to have a relationship with self-reported violence net of the effects of competing theoretical

variables (e.g., strain and social bonds) among a sample of university students in Turkey. In contrast, Cheung and Cheung (2008) found that the effects of low self-control on self-reported delinquency was reduced to non-significance once other theoretically relevant variables were included in the model (e.g., labeling, deviant peers association, and social bonds) among a sample of Chinese youth.

Other studies have examined the relative importance of low self-control in explaining antisocial behaviors for samples from different cultures and nations. For example, Morris, Wood, and Dunaway (2006) compared the association between self-control and substance use between a group of White high school students and Native American students. They found an association between low self-control and substance use among both Native Americans and Whites, although the effect was slightly higher for Native Americans. Similarly, Vazsyoni, Wittekind, Belliston, and Van Loh (2004) found an effect of low self-control on various types of self-reported antisocial behaviors (e.g., assault, theft, and school misconduct) and that these associations were similar across a sample of Japanese youths and a sample of American youths. Vazsonyi, Pickering, Junger, and Hessing (2001) found a relationship between low self-control and self-reported delinquency across samples of youth from four different countries (Hungary, Netherlands, Switzerland, and the United States). Rebellon, Straus, and Medeiros (2008) also examined the relationship between low self-control and self-reported offending across samples of university students from 32 countries and found the association between low self-control and crime to be significant across nations. Additionally, it was found that self-control was a better predictor of crime than delinquent peer association.

While not exhaustive, the previous review of the literature examining the relationship between self-control and deviant behavior provides some insight into the proposition of self-control theory since Pratt and Cullen's (2000) meta-analysis. In general, the findings across these studies are consistent with the findings of Pratt and Cullen. It appears that low self-control is an indicator of crime and analogous behaviors. However, this review also reveals that low self-control tends to be only modestly associated with such behaviors with other theoretical variables from rival explanations remaining important predictors. In sum, self-control appears to be one indicator of crime and analogous behaviors; however, it is not "the" individual-level explanation of crime as claimed by Gottfredson and Hirschi.

Where does self-control come from? Recently, research has begun to examine the development and sources of self-control. For the most part, researchers have tested Gottfredson and Hirschi's proposition that parenting is responsible for the development of self-control. Research in this area has taken two general forms: those that have simply examined the association between parenting and levels of self-control (e.g., Cochran et al., 1998) and those that have examined whether low self-control mediates the relationship between parenting and antisocial outcomes (e.g., Hay, 2001; Perrone, Sullivan, Pratt, & Margaryan, 2004; Unnever, Cullen, & Agnew, 2006).

Polakowski (1994) conducted one of the first empirical studies that explored the role of parenting in the development of self-control. Consistent with Gottfredson and Hirschi's contention, parenting was found to be associated with level of self-control at ages 8 – 10, but was unrelated to level of self-control at ages 12 – 14. Cochran et al. (1998) examined the effects of parenting on self-control among a sample of

undergraduate college students. Contrary to expectations, however, parental attachment was found to be related to level of self-control but parental supervision was not. Phythian, Keane, and Krull (2008) examined the effects of parenting and family structure on the development of self-control using a large nationally representative sample of youth. More specifically, the question was whether parental monitoring and discipline predicted levels of self-control. While it was found that poor and inconsistent discipline resulted in low self-control, the relationship between monitoring and self-control was found to be somewhat more complicated in that it varied by family structure. Furthermore, in intact families, monitoring was not important in the development of self-control; however, in single-parent families it was found to be a significant predictor of self-control.

As previously mentioned, other attempts to study the development of self-control have conducted mediation analyses in order to more thoroughly test the claim that the effect of parenting on crime will no longer exist once self-control is measured. Consistent with the theory, these studies find that parenting exerts a positive effect on self-control, suggesting that it is in fact responsible for the development of self-control. Additionally, the extant research finds that both parenting and level of self-control are negatively related to antisocial behavior. However, with the exception of one study in which low self-control was found to completely mediate the relationship between parenting and antisocial behavior (Gibbs, Giever, & Martin, 1998), most studies have found that self-control only partially mediates this relationship and that parenting continues to have a significant impact on antisocial behavior even when self-control is controlled (Gibbs, Giever, & Higgins, 2003; Hay, 2001; Perrone et al., 2004; Unnever,

Cullen & Pratt, 2003). A partial mediation effect of low self-control on the parenting-deviance relationship was also found among a Native American sample (Morris et al. 2007) and samples from nations other than the United States including the Netherlands (Finkenauer, Engels, & Baumeister, 2005; Vaszyoni & Belliston, 2007), Japan, Switzerland, and Hungary (Vaszyoni & Belliston, 2007). Partial mediation was also found in one study that accounted for constructs from competing explanations (i.e., learning) that were expected to also mediate this relationship (Unnever et al., 2006). In sum, the results from these studies suggest that self-control only partially mediates the relationship between parenting and delinquency. However, these studies relied on cross-sectional designs and a more rigorous test of this would require a longitudinal analysis in which parenting is measured prior to self-control and both are measured prior to delinquency.

Currently, only two studies have employed longitudinal designs in order to examine if self-control mediates the relationship between parenting and deviance. The findings from these studies are mixed (Burt, Simons, & Simons, 2006; Hope & Chapple, 2005). Hope and Chapple (2005) found some evidence for complete mediation. It was found that the relationships between parenting – both parental monitoring and parental attachment – and number of sexual partners were completed mediated by low self-control. They also found that the relationships between both parental monitoring and parental attachment and whether the child was in a committed or causal relationship were completed mediated by low self-control. They also found self-control to mediate the relationship between parental attachment and being sexually active. However, low self-control did not mediate the relationship between monitoring and being sexually active.

Alternatively, while Burt et al. (2006) did find parenting to have a somewhat stronger effect on the development of self-control than previous studies, consistent with results from cross-sectional studies they found that self-control only partially mediated the effects of parenting on delinquency. In conjunction with the findings from cross-sectional studies, the general findings suggest that parenting is in fact, at least partially responsible for the development in self-control; however, parenting also continues to be an important factor in behaviors that occur after self-control has presumably become a stable trait. It remains unclear from these studies whether parenting is the sole source of self-control as the theory so adamantly states.

In order to empirically assess Gottfredson and Hirschi's claims that parenting is the sole source of self-control, several studies have examined the importance of alternative socializing agents in the development of self-control. For example, studies have examined the impact of school (Beaver, Wright, & Maume, 2008; Burt et al., 2006; Meldrum, 2008; Turner, Piquero, & Pratt, 2005), neighborhood context (Gibson, Sullivan, Jones, & Piquero, 2010; Pratt, Turner, & Piquero, 2004; Turner et al., 2005; Teasdale & Silver, 2009), and peer association (Burt et al., 2006; Meldrum, 2008) on the development of self-control.

With regards to school socialization, Burt et al. (2006) found that attachment to teachers remained a significant predictor of the level of self-control even while controlling for parenting. In a longitudinal analysis, Beaver et al. (2008) found that school and classroom context (e.g., extent of misbehavior and crime) continued to explain variation in level of self-control beyond the effects of parenting. Meldrum (2008) also found that school socialization had a direct effect on the development of self-control

net of the effects of parental socialization. It was found that children who attended schools that effectively monitored their students showed increases in self-control compared to students in schools with poor monitoring practices; these school effects existed above and beyond the effects of parenting. Turner et al. (2005) examined whether the effect of school socialization on level of self-control varied by parenting style. The findings suggested that schools were more effective in developing self-control among those experiencing poor parenting compared to those experiencing good parenting.

Studies have also examined the effect of neighborhood context on the development of self-control. Consistent with Gottfredson and Hirschi, some researchers have found that neighborhoods do not influence the development of self-control (Gibson et al. 2010; Meldrum, 2008). However, other studies have found that neighborhoods do influence the development of self-control. For instance, Pratt et al. (2004) found that adverse neighborhood conditions had a direct negative impact on parenting and level of self-control. More importantly, neighborhood context emerged as having the strongest effect on level of self-control even while accounting for the effects of parenting. Similarly, Teasdale and Silver (2009) found that neighborhood context (i.e., neighborhood disadvantage and collective efficacy) had both a direct and an indirect effect through parenting on levels of self-control, with those in more advantaged neighborhoods having higher levels of self-control. Alternatively, while Turner et al. (2005) found that neighborhood context had a direct positive effect on level of self-control, they also found that parenting exerted a significant positive effect on self-control regardless of neighborhood context. Given this pattern of findings there are reasons to

doubt Gottfredson and Hirschi's contentions regarding the influence of neighborhoods on the development of self-control.

Only a few studies have examined the effect of peer association on self-control. Burt et al. (2006) found that increases in deviant peer association were associated with decreases in self-control over time. Accordingly, they found that increases in pro-social peer association were associated with increases in self-control over time. While Meldrum (2008) found that deviant peer association had a negative, contemporaneous effect on the development of self-control, they failed to find an effect of deviant peer association on levels of self-control measured at later time points. . Similarly, Wright, Beaver, Delisi, and Vaughn (2008) found that delinquent peer association explained differences in levels of self-control measured both contemporaneously and prospectively between pairs of paternal and fraternal twins. However, delinquent peer association did not explain differences in self-control within pairs of twins suggesting that the association found between twin pairs was due to a selection effect in which twin pairs with low self-control associate with delinquent peers.

Studies have also tested Gottfredson and Hirschi's claim against the intergenerational transmission of criminality by examining whether parenting practices mediate the relationship between parental self-control and child self-control (Boutwell & Beaver, 2010; Nofziger, 2008). Nofziger (2008) found that mothers with low self-control produced children with low self-control and that some of this association could be attributed to the type of parenting practices employed. Contrary to the theory, however, a significant direct effect of maternal self-control on the child's self-control remained. In a similar study, Boutwell and Beaver (2010) examined if both mothers' and fathers' level

of self-control were related to the child's level of self-control beyond the effects of parenting, neighborhood context, and neuropsychological deficits. Results from hierarchical regression analysis revealed that parental self-control in both cases was directly related to the child's level of self-control and was not mediated by any other factors. Contrary to self-control theory, both of these studies support the intergenerational transmission of self-control beyond parenting. Although Unnever et al. (2003) did not examine the intergenerational transmission of self-control, they did find that being diagnosed with Attention Deficit Hyperactivity Disorder was a significant predictor of low self-control net of the effects of parenting practices, suggesting support for a biological basis for self-control. These studies indicate that Gottfredson and Hirschi are not correct regarding the role of parenting as the singular source of self-control.

Additional studies also indicate that parenting is not the only source of self-control. Several studies have directly examined whether there is a genetic basis for level of self-control, mainly through the use of twin studies. For the most part these studies find that once the effects of shared and non-shared environmental factors on levels of self-control are accounted for, levels of self-control are more similar for monozygotic twins (i.e., those that share 100% of alleles) compared to dizygotic twins (i.e., those who share only 50% of alleles), suggesting that self-control is genetically transferred (Beaver et al., 2009; Wright & Beaver, 2005; Wright et al., 2008). Studies have also found support for a genetic transference of self-control through the use of genotyping (Beaver, DeLisi, Vaughn, & Wright, 2010; Beaver, Ratchford, & Ferguson, 2009). Beaver and colleagues (2009, 2010) examined the effects of genes and neurological deficits on levels of self-control. In both studies, DNA samples were taken in order to detect the presence

of genotypic polymorphisms. Beaver et al.(2009) examined if levels of serotonin, a neurotransmitter that controls impulses in the brain, were associated with level of self-control. While they did not reveal a direct significant effect of serotonin on levels of self-control, they did find that serotonin interacted with delinquent peer association in a way that predicted lower levels of self-control. Beaver et al. (2010) also examined whether neurobiological deficits (i.e., verbal ability) and genetic effects (i.e., MAOA gene activity) predicted levels of self-control. Because low MAOA gene activity has been found to be related to criminal behavior, it was expected that those with low levels of MAOA would have lower levels of self-control. Similar to the findings of Beaver et al. (2009), they found that MAOA gene activity did not have a direct effect on level of self-control. However, there was a significant interaction effect between MAOA and neurobiological deficits on self-control.

The general consensus of studies examining alternative sources of self-control suggests that there are multiple factors impacting the level of self-control beyond parenting. Studies examining contextual effects (e.g., neighborhood/community) suggest that parenting does not occur in a vacuum and that such factors impact self-control both directly and indirectly. Additionally, other social institutions (e.g., school) responsible for socializing children can be effective sources of self-control. It is also important to note that these studies find sources of self-control, including parenting, to impact self-control beyond the age at which Gottfredson and Hirschi suggest that it is set. Thus, one's level of self-control may be much more susceptible to change and less stable than the theory contends. In sum, the findings from these studies question the validity of

Gottfredson and Hirschi's claims regarding social agents responsible for the development of self-control, as well as it malleability beyond ages 8 – 10.

      Empirical status of the stability hypothesis. Recently, studies have begun to examine the stability hypothesis using a variety of methods and analytic techniques. Research results have been inconsistent; some find support for Gottfredson and Hirschi's contention that self-control is stable across the life-course, while others note that self-control is not as stable as the theory contends.

      Research examining the absolute stability of self-control has been inconsistent. Some studies have found that mean levels of self-control do not change. For example, Arneklev et al. (1998) did not find mean differences between self-control measured at the beginning and end of the semester among a group of undergraduates. Yun & Walsh (2010) also did not find any mean differences in self-control assessed yearly over five years (ages 14 – 18) among a sample of South Korean youth. Similarly, Raffaelli et al. (2005) did not find any mean differences between self-control measured when youth in their sample were ages 8 to 9 and subsequently at ages 12 to 13.

      Alternatively, some studies have found significant mean-level increases in self-control over time. Vazsonyi and Huang (2010) found an increase in mean-levels of self-control measured at three time points when children in their sample were ages 5, 9, and 11. Winfree et al. (2006) also found that mean levels of self-control gradually increased over five years among a sample of high school students. Finally, Turner and Piquero (2002) found gradual mean-level increases in self-control measured at seven different time points from childhood (age 7) through adolescence (age 19).

Mean-level analyses are somewhat limited in assessing stability. Because mean-level analyses assess absolute stability at the aggregate level, they may mask any within-individual change. Therefore, the finding that means do not change over time does not necessarily indicate that change is not occurring at the individual level. If individuals or groups of individuals are changing in opposite directions they would cancel each other out and such important changes would not be reflected in mean-level analyses.

Despite the limitations of mean-level analysis, only two studies have examined absolute stability using methods that account for within-individual changes in self-control over time. Both Arneklev et al. (1998) and Hay and Forrest (2006) used hierarchical linear modeling (HLM) to assess within-individual changes in self-control over time. Specifically, Arneklev et al. (1998) examined between-individual differences in self-control (i.e., level two) and within-individual change over time (i.e., level one). While they found significant differences between individuals on self-control, there was no evidence of within-individual change. However, in addition to employing a short time period between measurements (i.e., 4 - 5 months), self-control was only assessed at two time points. Using HLM in this way does not allow for the possibility that self-control changes in a non-linear manner. Alternatively, Hay and Forrest (2006) conducted HLM analysis on self-control measured at five separate time points (i.e., ages 7, 9, 11, 13, 15). Not only did they find within-individual changes in absolute levels self-control, but they also found that changes in parenting were partially responsible for these changes, even past the age that the theory suggests self-control is set.

Several researchers, however, have argued that the stability postulate is one of relative stability (i.e., rank-order consistency) as opposed to absolute stability (see Hay &

Forrest, 2006; Mitchell & McKenzie, 2006). Studies examining the relative stability of self-control have typically employed the use of stability coefficients. Stability coefficients are simply correlation coefficients between self-control scores measured at two time points. Research on the development of personality has suggested that correlation coefficients of .60 or higher are indicative of relative stability (Costa & McCrae, 1988). Based on this criterion, some studies have found support for Gottfredson and Hirschi's theoretical proposition that self-control is relatively stable, at least over the short term. For example, Arneklev et al. (1998) and Beaver et al. (2008) found scores on a measure of self-control assessed at two separate time points to be highly correlated (i.e., r's = .82 and .64, respectively). Vazsonyi and Huang (2010) found self-control assessed between ages 8 to 12 to be correlated at .70. Alternatively, several studies have not supported the relative stability of self-control by the same criterion. For example, Burt et al. (2006) found that self-control assessed when youth were ages 10-12 to be correlated with self-control at ages 12-14 at only 48. Using a two-wave panel design, Mitchell and McKenzie (2006) found scores on a measure of self-control to be correlated at .48 over a period of six months. Based on data collected from samples during similar developmental periods (i.e., ages 8 – 12), both Polakowski (1994), and Raffaelli et al. (2005) found self-control measured at the beginning of this period to be correlated with self-control measured at the end of this period at .59 and .50, respectively.

Other studies have found that as time increases between assessment periods, the relative stability of self-control decreases, suggesting that self-control is less stable over the long-term. Yun and Walsh (2010) reported correlations for self-control measured yearly at five waves. They found that the correlation decreased over time (wave one and

two, $r = .52$; wave one and waves three, four, and five r's = .47, .42, and .42, respectively). Winfree et al. (2006) produced similar findings for self-control measured yearly over five waves (r's = .58, .48, .44, and .44, respectively). Turner and Piquero (2002) found correlations ranging from .33 to .68 over seven waves of data, with those measurement periods further apart having correlations with lower magnitudes.

In sum, studies assessing the relative stability of self-control through the use of stability coefficients question Gottfredson and Hirschi's claim that individuals will remain within their rank-order position on self-control over time.   The results from these studies tend to produce correlations that do not reach the suggested criterion of .60. Additionally, the few studies that do find coefficients that meet the .60 cutoff tend to be those that have relied on shorter time periods between data points. This may, in turn, inflate the magnitude of the correlations as study participants are subject to measurement recall.

It is important to note the limitations of using stability coefficients in assessing the relative stability of self-control. Similar to mean-level analysis, correlations are aggregate measures of stability and, therefore, might conceal individual differences in stability (Lamiell, 1981; Mroczek, 2007). For example, if a large portion of the sample had consistent scores on a measure of self-control, a relatively strong coefficient would be produced even if there were changes for a smaller, yet meaningful, number of individuals within the sample. Another important limitation is that even when self-control is assessed at more than two time points, the use of correlations limits the analyses in that the resulting stability coefficient only represents correlations between two measurement periods.   Thus, correlations do not utilize all the information available

and fail to account for nonlinear developmental patterns (i.e., changes; Mroczek, 2007). Additionally, correlation coefficients do not account for the possibility that there may be smaller, yet non-trivial, groups of individuals who evince change in development of self-control (Blonigen, 2010; Mroczek, 2007). Thus, inconsistent with Gottfredson and Hirschi's claims that self-control is stable for everyone once set at ages 8 – 10, it is possible that for a smaller portion of individuals self-control is not stable. Some individuals may begin acquiring self-control at a later age, some may develop self-control at a slower rate, and others may actually decrease in self-control over time.

Research supporting the identification of distinct developmental patterns in offending also provides indirect support for the notion that there may be distinct developmental patterns in the development of self-control. With a few exceptions (Piquero, Blumstein, Brame, Haapanen, Mulvey, & Nagin, 2001; Sampson & Laub, 2003), most studies tend to find that four different groups exist (Blokland & Nieuwbeerta, 2005; Chung et al., 2002; D'Unger et al., 1998; Fergusson et al., 2000; Laub et al., 1998; Nagin et al., 1995; Nagin & Land, 1993) – non-offending, moderate offending, adolescent onset, and chronic offending groups. If self-control underlies offending, then it may be possible that developmental patterns in self-control parallel those found for offending behavior. For example, it is possible that those in the high-chronic offending group are characterized by persistent low self-control while those in the non-offending and moderate offending groups are characterized by relatively higher, stable levels of self-control. Accordingly, those in the adolescent onset group are more likely characterized by changing levels of self-control. It may be that these individuals

develop self-control later than moderate or low-level offending groups or that these individuals actually decline in self-control during this period.

The invariance of the age crime curve also provides similar support for the notion that individuals may follow unique developmental patterns in self-control. If self-control is as highly related to offending as Gottfredson and Hirschi claim, then it would be expected that the two would covary. In this sense, it may be that developmental patterns in self-control parallel the age crime curve. It may also be that unique trajectories in self-control underlie the age-crime curve. For example, those individuals responsible for a large proportion of offending may not begin to develop self-control until late adolescence at which point they acquire self-control at a high rate. This would explain the decrease in aggregate measures of offending typically found.

It is important to note that this perspective is contradictory to Gottfredson and Hirschi's theory. They counter this notion by suggesting that it is not self-control that changes, it is the behavior that changes. As previously mentioned, individuals lowest on self-control will always be the lowest within their cohort according to the theory. Those low on self-control will always be more likely to engage in antisocial behavior than those high on self-control even as they age. However, the types of behaviors or manifestations of low self-control will change as individuals age. Therefore, while offending decreases for everyone, levels of self-control do not change. The implications of finding groups that follow unique developmental patterns in self-control would contradict the theoretical propositions put forth by Gottfredson and Hirschi.

Research on personality development also provides indirect evidence for the possibility that not all individuals follow similar patterns in the development of self-

control and that a variety of distinct developmental patterns exist (Blonigen, 2010).

Studies examining the stability of personality traits, some that overlap with the concept of

self-control, support this possibility. Roberts, Caspi, and Moffitt (2001) found that while

73% of their sample maintained the same levels of Negative Emotionality (NEM; e.g.,

anger, antagonism, and anxiety), 20% decreased on NEM, and 7% (a small, yet

meaningful portion) of the sample increased their levels of NEM. While Robins, Fraley,

Roberts, and Trzesniewski (2001) found that the majority of their sample followed

normative trends in the development of global personality traits (e.g., agreeableness,

conscientiousness, and neuroticism) from late adolescence into young adulthood, they did

identify a small group that decreased on conscientiousness during this period. Johnson,

Hicks, McGue, and Iacono (2007), using growth mixture modeling, identified distinct

developmental trajectories for each facet of the Multidimensional Personality

Questionnaire (MPQ; Tellegen, 2006). Most notably, they found three groups for Well-

being: one which remained stable over time, one that started low and increased, and one

that started moderate and decreased. For the measure "Alienation, Aggression, and Harm

Avoidance," they found four distinct groups; and one group that started high yet declined

at a much faster rate than the other three groups. Similarly, Cote, Tremblay, Nagin,

Zoccolillo, and Vitaro (2002) found four distinct impulsivity trajectories for a sample of

young boys over a span of seven years (i.e., ages 6 – 12). They identified one group that

remained low on impulsivity during this period, another group that remained relatively

higher than the other groups, and two groups that evinced considerable change: one that

began low on impulsivity and increased over time and one than started with moderate

levels of impulsivity and decreased over time. Schaeffer, Petrus, Ialongo, Poduska, and

Kellam (2003) examined trajectories of aggression for youth between the first through the seventh grades. They found four distinct developmental patterns that included three groups that remained relatively stable (low, moderate, and high aggression); however, they identified one group that began low and increased to levels of aggression that surpassed the high-stable aggressive group. While these studies find distinct developmental trajectories in personality traits related to offending similar to self-control, they do not directly examine trajectories in self-control.

Only a few studies have examined the possibility that different groups follow distinct developmental patterns in self-control. For example, Turner and Piquero (2002) found that males maintained significantly lower levels of self-control compared to females over seven waves of data collection. They also found that while White and minority youths had similar levels of self-control from ages seven to thirteen, Whites had significantly higher levels of self-control from ages fifteen to nineteen, suggesting that Whites develop self-control faster than non-Whites. Regarding developmental patterns of self-control by gender, Winfree et al. (2006) also found that males scored significantly lower on self-control over the course of five years compared to females. They also found that developmental patterns differed by race. Specifically, they found that African Americans reported significantly lower levels of self-control than Hispanics during the second year, that Hispanics had higher scores by the fourth year, and that Whites scored significantly lower on self-control during the last two years compared to African Americans. While these findings suggest that there are different developmental patterns of self-control for certain groups, they rely on a-priori identified characteristics such as demographic characteristics (e.g., gender and race) and offending status to determine

group membership. These studies assume that individuals who are similar on certain characteristics share similar developmental trajectories in self-control. While there may be both theoretical and empirical bases for expecting individuals associated with such groups to have similar life experiences and, thus, share similar trajectories in self-control, studies taking this approach may overlook similarities and differences in development not associated with these group characteristics.

Group-based trajectory modeling is a semi-parametric method designed to identify groups with distinct developmental trajectories without preconceived notions about what constitutes a group (see e.g., Jones & Nagin, 2007). However, only two studies have used this technique to identify if there are, in fact, groups of individuals that follow distinct developmental patterns in self-control. Both Higgins et al. (2009) and Hay and Forrest (2006) attempted to identify groups of individuals that follow unique developmental patterns of self-control using semi-parametric group-based trajectory modeling. Higgins et al. (2009) assessed the stability of self-control among a nationally representative sample for youth between ages of 12 - 16. Their group-based trajectory analysis identified five separate groups with different developmental trajectories in self-control. Specifically, they identified a group that maintained high levels of self-control over the five years which was made up of 12% of the sample. They identified another group that maintained moderate levels of self-control over the study period that made up 35% of the sample and another group that maintained slightly lower mean levels of self-control that accounted for 13% of the sample. They identified a fourth group that continued to evince low levels of self-control over the study period that consisted of 23% of the sample. The within-group and between-group levels of self-control among these

four groups did not change, suggesting both absolute and relative stability for a majority

of the sample (83%). However, one group consisting of 17% of the sample was

identified that started with high levels of self-control and gradually decreased in their

levels self-control over the five waves. The identification of this group suggested that

self-control is not stable for a small, yet meaningful group of individuals. In addition to

identifying trajectories of self-control they also identified trajectories of violent

victimization. They identified three trajectory groups for violent victimization: one that

showed no victimization, one with modest levels of victimization, and one that showed a

sharp increase in victimization around the age of 14. They then linked trajectories of

self-control to trajectories a victimization. The results revealed an association between

trajectories of self-control and trajectories of victimization. It was found that those

groups follow high trajectories of self-control were more likely to be in the trajectory that

evinced no victimization. Accordingly, those that were identified as following

trajectories of low levels of self-control were more likely to follow trajectories marked by

some degree of victimization.

In their trajectory analysis, Hay and Forrest (2006) identified eight groups with

different trajectories in self-control. Four of the eight groups were characterized by

stability: a very high-stable group (12%); a high stable group (42%); a medium-stable

group (26%); and a low-stable group (4%). However, they also identified four groups

that were marked by change. One group started low on self-control and gradually

increased over time (i.e., low-increasing group) and accounted for 5% of the sample.

Two groups showed decreasing levels of self-control over time: one that started high on

self-control and one that started with moderate levels of self-control and decreased over

time (i.e., high-decreasing and medium-decreasing, respectively) and accounted for 1% and 9% of the sample, respectively. Finally, they identified a group who followed a curvilinear trajectory, starting low and continuing to decrease but then showed an increase near the end of the time period; this group accounting for 1% of the sample. Based on these findings, they concluded that self-control is stable for a majority of individuals (84%). However, they identified a smaller, yet sizeable group of individuals for which self-control was not stable in the absolute or relative sense. Two of the groups evinced within-group increases in self-control over time. While it is not completely clear from the theory if absolute increases contradict its propositions regarding stability, two groups were identified as having within-group losses in self-control. This finding is at odds with Gottfredson and Hirschi's theory as they clearly state that self-control cannot be lost. Also, they found that some of the group trajectories intersected with or crossed many of the other group trajectories. They interpreted this as showing that some groups' trajectories change enough to alter their rank-order position, questioning the relative stability of self-control.

In addition to identifying trajectories of self-control, they also examined if changes in parenting continued to influence levels of self-control past ages 8 – 10 using hierarchical linear modeling. They found that changes in parenting accounted for within-individual changes in self-control such that increases in the quality of parenting resulting in increases in self-control and decreases in the quality of parenting resulting in decreases in self-control. They interpreted these findings as suggesting that changes in parenting are responsible for rank-order changes in levels of self-control.

The findings between these two studies are consistent in that they both find similar proportions of their samples to be marked by both stability and change in self-control (approximately 85% and 15%, respectively). Alternatively, the number of groups identified in each of these studies is different, with Higgins et al. (2009) identifying five groups and Hay and Forrest (2006) identifying 8 groups. These differences in the number of groups may be a function of the sample size, with the former study relying on a smaller sample size ($n = 408$) and the latter using a larger sample size ($n = 3,793$). Also, while both studies identify groups that evince decreases in self-control, a finding at odds with Gottfredson and Hirschi, only in one of these studies were groups identified that were marked by increases in self-control (Hay & Forrest, 2006).

It is important that these studies be replicated and extended. In addition to the fact that these are the only two existing studies that attempt to identify unique developmental trajectories, there is a need for replication of these findings among a different sample in an attempt to reconcile some of the inconsistencies. While both found similar proportions of their samples were stable (or not), the number of groups differed. Thus, replicating these studies should provide greater clarity. There is also a need for research that expands upon those of the prior two studies. While Hay and Forrest (2006) did examine if parenting accounted for changes in self-control, they did not directly link parenting to the trajectories of self-control that they identified. Research is needed that not only examines if parenting distinguishes trajectories of self-control, but also if other competing factors distinguish trajectory groups of self-control. Currently, there is no information available that begins to address why there are different trajectories. The general theory does not suggest different groups will be identified. Thus, there are no

theoretical insights that can be gleaned. Unfortunately, there are also no empirical studies that examine factors associated with group membership. These gaps in the literature need to be filled. If factors are found that differentiate between the different trajectories, it might shed light on distinct etiological or developmental pathways. This, in turn, can be used to refine theory, but also scientifically-inform prevention and intervention strategies.

A summary of the empirical status of self-control theory. Many of the propositions contained within Gottfredson and Hirschi's theory have not received consistent empirical support and suggest the validity of many of their claims need to be reconsidered. Their claim that self-control is the sole factor in explaining antisocial behavior has generally been rejected, with several studies finding that other theoretical constructs continue to explain a significant amount of variance in antisocial outcomes. This is not to dismiss the fact that low self-control continues to have a significant effect on antisocial behavior; in several cases its effect is stronger than other theoretical factors (Pratt & Cullen, 2000). A modification of Gottfredson and Hirschi's theory may require incorporating how low self-control interacts with other variables to better explain antisocial behavior.

Gottfredson and Hirschi also suggest that parenting, and to some extent schools, are the socializing agents responsible for the development of self-control, claiming that self-control will completely mediate the association between parenting (or school) and antisocial behavior. However, much of the literature finds that low self-control does not fully mediate the relationship between parenting and antisocial behavior; in many cases parenting continues to exert a direct effect on antisocial behavior beyond the effects of

self-control, a finding that is inconsistent with Gottfredson and Hirschi's claim. Additionally, in studies that do find a relationship between parenting and self-control, the association tends to be modest and other factors are identified as being important in its development. Thus, parenting appears not to be the only socializing agent that contributes to the development of self-control. Other sources of socialization exert a direct effect on self-control such as peer association or biological factors, while structural factors such as neighborhood context and socioeconomic status may work indirectly through parenting to influence one's level of self-control. In this case, the propositions of the theory as they are currently stated should be reconsidered to incorporate those empirically-validated factors that influence the formation and development of self-control.

A reformulation may also be necessary for the stability hypothesis. As the previous review of the literature shows, self-control is stable for most individuals. However, there are also findings that suggest it is not stable for everyone. This finding may likely be due to the fact that not everyone follows the same developmental pattern and the theory should account for this possibility. While it may be that most individuals follow normative developmental patterns in self-control, other individuals may follow unique developmental patterns. For example, some may begin to develop self-control in later developmental stages only at a much higher rate, while others may begin earlier at slower rates.

This line of reasoning is in line with theoretical explanations of patterns in offending such as that put forth by Moffitt (1993). Moffitt's taxonomy of offending behavior describes two groups with distinct developmental patterns in offending:

adolescent-limited (ALs) and life-course persistent (LCPs) offenders. She describes the ALs as having normative offending patterns, engaging in antisocial behavior during adolescence and then quickly desisting in adulthood. Alternatively, the LCPs begin engaging in antisocial behavior very early in development and persisting into adulthood. Moffitt also suggests that the offending patterns in each of these groups has distinct etiologies, with the ALs explained by peer influence and social mimicry while the LCPs are characterized as having neurological deficits and poor executive functioning. Moffitt's taxonomy offers an explanation of distinct patterns in offending that underlie aggregate patterns such as that depicted in the age-crime curve. Applying a similar approach to the development of self-control may help to identify and explain distinct developmental patterns in self-control that underlie aggregate patterns in its development. This approach would provide a more precise and thorough explanation for its development across all individuals, even those who do not follow normative patterns in its development.

Factors distinguishing developmental patterns of self-control. While no studies have identified whether certain factors can differentiate between distinct developmental trajectories in self-control, research identifying factors that differentiate between distinct developmental trajectories in offending provides indirect support for those factors that may be important. For example, Nagin (1999) found that individuals identified as having persistent offending trajectories (i.e., chronic offenders) were more likely to come from low-income households, have experienced poor parenting, and to have parents with criminal histories. Fergusson et al. (2000) found that individuals with distinct developmental trajectories in offending (i.e., non-offending, moderate,

adolescence-limited, and chronic offending groups) had differential levels of family dysfunction (e.g., parental criminality, alcohol, and drug use), social disadvantage, and deviant peer associations. Fergusson et al. (2002) also found that parental criminality, gender, and parental conflict were associated with being in the chronic offending group compared to other offending trajectories. Weisner and Capaldi (2003) found that those who were classified as being chronic were more likely to have poor parenting compared to those in the non-offending or rare-offending groups. They also found that those identified as having decreasing offending trajectories were less likely to associate with delinquent peers than those in the chronic offending groups. Finally, Chung et al. (2002) found that those youth with desisting trajectories in offending are more likely to experience better parenting, less family conflict, higher levels of school commitment and attachment, and have fewer delinquent peers compared to those with increasing offending trajectories.

Research has also identified several factors responsible for the development of self-control, including parenting (e.g., Finkenauer et al., 2005; Gibbs et al., 2003; 1998; Hay, 2001; Morris et al., 2007; Perrone et al., 2004; Unnever et al., 2003; Unnever et al., 2006; Vazsonyi & Belliston, 2007), school (Beaver et al., 2008; Burt et al., 2006; Meldrum, 2008; Turner et al., 2005), neighborhood context (Gibson et al., 2010; Pratt et al., 2004; Turner et al., 2005; Teasdale & Silver, 2009), peer association (Burt et al., 2006; Meldrum, 2008), and biological factors (e.g., Beaver et al., 2009a; Boutwell & Beaver, 2010; Nofziger, 2008; Wright & Beaver, 2005; Wright et al., 2008). It is possible that these factors identified as important in the development of self-control may also be associated with the unique trajectories that individuals follow and, thus, able to

differentiate among distinct developmental patterns. However, research has yet to directly examine if certain factors are able to distinguish between different developmental trajectories of self-control. While Hay and Forrest (2006) did identify distinct developmental trajectories in self-control and separately found that increases in parenting resulted in subsequent increases in self-control, they did not examine if parenting could distinguish among the developmental trajectories that they identified in their sample.

Together, findings from these studies suggest that factors important in distinguishing developmental trajectories in offending such as parental characteristics, parenting style, school socialization, and delinquent peer association are similar to those that have been found to be responsible for the development of self-control. Thus, it is possible that these factors are also able to distinguish among different developmental trajectories in self-control; however, studies have yet to directly examine if these risk factors are associated with having a certain developmental trajectory of self-control.

Only two studies have attempted to identify unique developmental trajectories of self-control (Hay & Forrest, 2006; Higgins et al., 2009). These two studies suggest that for a majority of their samples self-control was stable; however both identified groups marked by change. The proportion of those for which self-control was identified as not stable were similar between these two studies. However, the number of groups identified and the patterns for which those groups followed were not similar between these two studies. Therefore, replication of these studies with a different sample is necessary to confirm those findings that were consistent between these two studies, as well as to reconcile some the inconsistent findings. Research is also needed that expands upon the

previous two studies by identifying if factors are directly related to development trajectories of self-control.

The empirical evidence regarding many of the propositions of self-control theory suggest a need for its reformulation. Similarly, research on the stability hypothesis suggests that while it is stable for a majority of individuals it is not stable for everyone, and point toward the possibility that some individuals follow unique developmental trajectories even beyond the ages 8 - 10. This finding is at odds with Gottfredson and Hirschi's claim that self-control is stable for everyone once it is set and that everyone will follow the same developmental pattern. This, in turn, suggests a need for modifications to this portion of the theory as well. Given that only two studies have directly examined this (Hay & Forrest; Higgins et al., 2009), more research is needed that confirms their findings and provides direction for the modifications that are needed. This requires replication as well as expansion. Replication of these studies can provide confidence in the necessary modifications, and identification of risk factors that distinguish unique trajectories of self-control can provide insight into the underlying causes of unique developmental trajectories.

CHAPTER 3:

METHODS

Data Collection Procedures

The data used in the current study were taken from the Rural Substance Abuse and Violence Project (RSVP; NIDA Grant DA-11317). The RSVP was a longitudinal study in which data were collected from a large sample of youth from middle schools and high schools located in the state of Kentucky. The RSVP study was designed to collect individual and contextual data about study participants known to influence criminal offending, victimization, and substance abuse. The RSVP used a multi-stage sampling technique to select study participants. Based on population-based strata, 30 counties located within the state of Kentucky were randomly selected with rural counties over sampled in order to ensure representativeness. In order to be considered for inclusion schools had to be public and include 7th graders.

Schools within each county were systematically selected to participate in order to represent both urban and rural areas. Within the 30 counties, 74 middle schools were eligible and asked to participate in the study. Of the 74 schools that were sampled, 9 declined to take part leaving a total of 65 middle schools from which 7th grade students were recruited to participate. At the start of data collection there were a total of 9,488 7th graders within these schools who were recruited for participation. Since the study design was longitudinal and students were to be followed over multiple waves of data collection,

it was necessary to be able to identify youth who participated in the study. Because unique identifiers were used to track students over the four waves, it was required by the Institutional Review Board that active consent be obtained from the parents. Parental consent was obtained by mailing consent forms to the homes of parents. Parental consent was obtained for 4,102 (43%) of the students. Data was collected from multiple sources (i.e., students, teachers, and principals) for those students for which parental consent was granted. The survey was administered over four waves of data collection beginning in 2001 when students were in the 7th grade and ending in 2004 when they were in the 10th grade. Over the entire four years of data collection there was at least one completed survey for 3,976 of the participants; however, at each consecutive wave beginning with the first there were 3,692, 3,638, 3,050, and 3,040 completed surveys, respectively.

Participants

In the current study only those individuals who had data on self-control at three time points were included in the analyses. Of the 3,976 individuals who had at least one completed survey, 727 (18%) had self-control measurements for only two or fewer time points with valid data on self-control and were therefore omitted from the analyses. This resulted in a final sample size of 3,249 individuals who had data on self-control for at least three time points. Of those 3,249 individuals included in the final sample, 159 (4.9%) are African American, 2791 (85.9%) are White, 59 (1.8%) are mixed race (Black and White), 16 (0.5%) are Native American, 16 (0.5%) are Asian American, 46 (1.4%) reported being "other", and 162 (5%) has missing information on race. A slight majority of the sample was female (n = 1655; 51%) compared to males (n = 1431, 44%). The

racial and gender makeup of the final sample of the current study are consistent with and representative of the Kentucky public school system as reported for the 2009-10 school year

(http://www.education.ky.gov/KDE/HomePageRepository/News+Room/Kentucky+Education+Facts.htm).

Table 1 reports the descriptive statistics for these individuals on all variables included in the current study. A small proportion of the sample reported that one of theirparents had ever been arrested. Although the maximum and minimum for age suggest a wider range of ages at each grade, only a small proportion of the individuals fell outside of the typical age range at each grade. For example, in the 7th grade there were ten 12 year-olds, seventy-one 15 year-olds, two 16 year-olds, two 17 year-olds, and one 19 year-old. The majority of the sample (n = 3163; 97%) reported being either 13 or 14 at grade 7. Also reported in Table 1 are the mean levels of self-control for the sample at each grade which suggest that self-control is fairly stable across the four time points (see discussion below).

Mean levels of types of mother parenting (attachment and supervision) are on the higher end of the continuum with values clustering around the mean. Table 1 also suggests that father parenting, on average, is at the lower end of the potential range and the standard deviations suggest that there is considerable variation in the level of parenting by the father reported in the sample. Also, on average, participants appeared to report levels of both school commitment and belief in the school rules that fall closer to the upper range of the scale. Finally, mean levels of peer delinquency are closer to the scale minimum.

Table 1. *Descriptive statistics for study variables*

	Valid n	*Mean*	*S.D.*	Minimum	Maximum
Minority	3087	.10	0.29	0	1
Female	3086	.54	0.50	0	1
Parental Crime	3027	.21	0.41	0	1
Age					
Grade 7	3249	13.39	0.56	12	19
Grade 8	3249	14.39	0.56	13	20
Grade 9	3249	15.39	0.56	14	21
Grade 10	3249	16.39	0.56	15	22
Self-Control					
Grade 7	3038	31.51	6.76	10	40
Grade 8	3171	31.50	6.86	10	40
Grade 9	2943	32.77	6.72	10	40
Grade 10	2940	32.75	6.85	10	40
Parenting					
Mother					
Attachment	3073	18.98	4.41	3	25
Supervision	3072	17.45	3.06	4	20
Father	3007	36.71	10.45	1	50
School Bonds					
Commitment	3072	16.41	2.97	3	20
Rules	3089	20.11	4.43	4	28
Deviant Peers	2476	1.47	2.50	0	12

Comparisons were made between those individuals who were excluded from subsequent analyses to those who were retained based on having a measure of self-control for at least three waves of data on all variables included in the analyses. According to these analyses, those who were excluded were more likely to be male, $\chi^2(1, N = 3,678) = 0.06$, $p <.001$, $\varphi = .06$; more likely to be White, $\chi^2(1, N = 3,676) = 30.60$, $p <.001$, $\varphi = .09$; and less likely to have a parent who had been to jail or prison, $\chi^2(1, N = 3,586) = 53.97$, $p <.001$, $\varphi = -.12$. Those who were excluded also had significantly lower mother attachment, $t(3656) = -6.15$, $p < .001$, $d = -.20$; mother supervision, $t(3655) = -5.97$, $p < .001$, $d = -.20$; father parenting, $t(3576) = -7.37$, $p < .001$, $d = -.25$; school commitment, $t(3688) = -6.07$, $p < .001$, $d = -.20$; and belief in school rules, $t(3672) = -5.56$, $p = .003$, $d = -.18$. Also, those excluded reported that their peers engaged in significantly more delinquency than those who were in the sample $t(2926) = 2.43$, $p = .003$, $d = .09$. As would be expected, it was also found that those who were missing more than one wave of data on self-control had significantly lower levels of self-control measured during the 7th grade, $t(3569) = -6.69$, $p < .001$, $d = -.22$. Because these differences in key variables were found between those included in the analyses and those that were not, there is the potential for systematic attrition. Specifically, these comparisons suggest the possibility that individuals discontinued their participation as a result of low self-control. Therefore, the current analyses may be over-representing those with higher levels of self-control and under-representing those with lower self-control, as well as those with more risk factors (e.g., poor parenting and deviant peer association). It is important to take these differences and the potential for sampling bias in account when

interpreting the results from the current study. Yet, it should also be noted that the effect sizes reported above are rather small.

Measures: Dependent Variable

   Self-control. A 10-item measure of self-control was developed for use in the current study. The items used to represent self-control were selected based on face validity and assess the extent that respondents are able to control their own behavior (e.g., *When I am angry, I lose control over my actions*) and focus or pay attention (e.g., *Little things or distractions/interruptions throw me off*), especially when such behavior would be most important (e.g., *I have difficulty remaining seated at school;* see Appendix A for a complete list of items). Response sets for items were based on four-point Likert scales (1 = never true – 4 = always true). Each item was reverse coded and a total self-control score was produced by summing all the items at each wave. Thus, higher scores represent higher levels of self-control. The 10 items measured at each wave were subject to a principal components analysis. Observation of the component loadings and scree plot identified a one factor solution at waves one, two, and three. Wave four revealed two factors due to a few items double loading; however, the scree plot suggested that a one-factor solution best fit the data. The items at each wave were also subject to reliability analysis revealing excellent internal consistency alphas ranging from .89 - .92. A visual inspection of the distribution of scores on the self-control measure appeared to resemble a normal distribution with some clustering at the minimum and a smaller cluster at the maximum end of the scale. This is important for specifying the correct model in trajectory analysis (see below).

Measures: Risk Factors

Data on several theoretically and empirically relevant variables are included in the analyses. Information on all risk factors were collected at wave one, although it is important to note the specific terminology used (see Appendix A for a complete list of items on scales for risk factors). For example, although the wording of items on parenting (e.g., *My mother/father seems to understand me* and *My mother/father knows where I am when I am away from home*) and school bonds (e.g., *Everyone knows what the school rules are* and *The school rules are strictly enforced*) are asked about in the present tense, they actually measure what has occurred in the past. Other items more clearly referenced past events. For example, items inquiring about deviant peer association use past tense (e.g., *Thinking about your closest friends – How many of them have done any of the following things in the present school year? – sold marijuana or other drugs*) and one item inquires about parental criminality, and whether this has occurred at any time in the past. This suggests that such an event occurred prior to wave 1 data collection (see appendix for scale items). After the identification of trajectories of self-control, these variables are included in a multinomial logistic regression analysis in order to examine if they are more or less prevalent for certain groups.

Parenting. Both mother parenting and father parenting were measured at wave one in the current study. Both sources of parenting were measured based on 10 items in which individuals responded to questions about their mother's/father's parenting style using a 5-point Likert scale (1 = never – 5 = always). Responses were summed for items reflecting mother and father parenting to yield overall mother parenting and overall father parenting with higher scores indicative of better parenting. Items on the scale reflect Gottfredson and Hirschi's (1990) notion of monitoring/supervision (e.g., *My*

mother/father knows where I am when I am away from home; My mother/father knows who I am with when I am away from home).

While the measures used in the current analyses do not directly assess parents ability to recognize bad behavior or discipline, these can be inferred from responses to items about monitoring/discipline. For example, the omission of the recognition element has been addressed before (see Gibbs et al.; 1998; Hay, 2001) suggesting that parents who are likely to supervise and monitor their children are also likely to recognize bad behavior and respond to it using discipline. Thus, the omission of these elements is not as problematic as originally thought. Additionally, both parenting scales include items measuring parental attachment (e.g., *My mother/father makes me feel wanted; I share my thoughts and feelings with my mother/father*). Although Gottfredson and Hirschi suggest that parental attachment does not need to be represented in measures of parenting since attachment is implied when parents successfully carry out the other three components, it has been found that measures of parenting that included attachment explain additional variance in self-control compared to measures that strictly follow the monitoring, recognition, and discipline model (see e.g., Hay, 2001; Perrone et al., 2004).

Items reflecting mother parenting and father parenting were each subject to principal components analysis with varimax rotation. Observation of the factor loadings and scree plot for the items from the mother scale revealed a two-factor structure with one factor representing supervision (4 items) and the other representing attachment (6 items), while the father scale revealed a single-factor structure for all ten items. Thus, there are two scales assessing mother supervision and attachment and one father

parenting scale. Items for both mother and father parenting measures showed good internal consistency (α's = .86 and .93, respectively).

Delinquent peer association. Delinquent peer association was based on items asking respondents to indicate the number of their friends that had engaged in 12 specific types of delinquency. Items included acts from smoked marijuana to having physically attacked someone (example: punched, slapped, kicked) and for each item respondents were asked, *Thinking of your <u>closest</u> friends – How many of them have done any of the following things in the present school year?* Each item was binary coded so that responses indicating that none of their friends had engaged in any specific type of behavior were coded as "0" and those indicating that one or more of their friends engaged any specific type of behavior were coded as "1". These items were then summed to obtain a variety of peer delinquency scale where higher scores are indicative of more variety in peer delinquency.

School bonding. School bonding was measured by 12 items in which respondents answer questions about their school based on a 4-point Likert scale (1 = strongly disagree – 4 = strongly agree). In addition, items included in the measure of school socialization also capture the extent to which students feel committed to school. The 12 items were then subject to principal components analysis using varimax rotation. The factor loadings and scree plot identified two distinct components. Specifically, one component was identified that represented one's "belief in school rules" and was comprised of 7 items (e.g., *Everyone knows what the school rules are*; *Teachers keep order in the classroom*; *The school rules are strictly enforced*). The other component was comprised of 5 items that captured "school commitment" (e.g., *I care a lot what my teachers think of*

me; Getting an education is important to me). The two school bonding scales evinced good reliability (α's = .77 and .69, respectively).

Parental crime. In order to account for the intergenerational transmission of criminality, the current study also includes a measure of parental crime. Respondents were asked about if either one of their parents had ever been in jail or prison (1 = yes, 0 = no).

Control variables. Individuals in the current study were asked to indicate their race and gender. Gender was binary coded (1 = male, 0 = female). In order to measure race, individuals were asked to identify themselves as one of the following: African-American, Asian-American, Native-American, White, White and Black, or Other. Responses were then recoded into a binary outcome of White (1) or minority (0). Both race and gender are associated with levels self-control (Gottfredson & Hirschi, 1990) and, thus, it is necessary to statistically control for them.

CHAPTER 4:

ANALYTIC PLAN

In the current study, several steps were taken to test the stability hypothesis using both traditional and a more contemporary method for examining the stability of traits. First, mean-level differences in levels of self-control across time were examined in order to test the absolute stability of self-control. Second, rank-order, or relative stability of self-control was examined using correlational analyses. The results from both of these analyses allowed for a comparison between the stability of self-control found in the current sample and that found in previous studies. Third, after assessing stability using more traditional methods, the current study applied group-based trajectory modeling in order to identify relatively homogenous groups that follow distinct patterns in the development of self-control and assess the extent that more traditional methods mask the identification of such groups. The fourth step examined if there were mean differences across groups on the relevant risk factors. Finally, in order to account for the unique effects of the risk factors in accounting for group membership, mean differences in risk factors across groups were examined and a multinomial logistic regression was conducted in order to assess the unique association between risk factors and group membership.

In sum, the following analyses were conducted in this specific order:

1.) Mean-level differences in self-control across all waves.

2.) Stability coefficients were examined for self-control measured at each wave with each other wave.

3.) Group trajectories of developmental patterns of self-control across time were examined.

4.) Mean differences in risk factors across groups identified in trajectory modeling were assessed.

5.) The unique ability of each risk factor in distinguishing among groups was examined.

Assessing Absolute Stability

In order to discover if there are absolute changes in the level of self-control for the entire sample, the means of self-control were computed at each wave. Additionally, a repeated-measure ANOVA was conducted in order to examine if, on average, individuals' levels of self-control varies significantly across the four waves. Specifically, the within-factor is age at each of the four waves of data collection and the dependent variable is level of self-control measured at each age. According to the theory, it is expected that mean levels of self-control will remain constant. A significant decrease or increase in mean-levels of self-control would contradict the theory.

Assessing Relative Stability

Stability coefficients were examined in order to assess the extent that self-control is relatively stable over time. Spearman rank-order correlations were calculated between self-control measured at each wave. Stability coefficients reaching .60 or higher have typically been considered to represent a high degree of stability (Costa & McCrae, 1988). Correlations found to be equal to or greater than .60 would support the theory, suggesting

a high degree of relative or rank-ordered stability. Correlations less than .60 would contradict the theory, suggesting that self-control is not relatively stable for everyone and that, for some individuals, self-control changes enough to alter the rank-order positioning.

Identification of Developmental Trajectories

While mean-level analyses and stability coefficients are informative regarding the stability of traits, both are limited in their ability to identify unique developmental patterns. More importantly, traditional methods of assessing stability overlook the possibility that there are homogenous subgroups of individuals that share similar patterns in development. In order to identify such groups with distinct trajectories in the development of self-control, the current study employed semi-parametric group-based trajectory modeling. Group-based trajectory modeling enables the identification of homogenous clusters of individuals with similar developmental patterns (Nagin, 2005).

Background on group-based trajectory modeling. Two more common methods used to examine developmental trajectories – hierarchical modeling and latent growth curve analysis – are similar to group-based trajectory modeling in that all three can specify the shape of developmental trajectories as a function of age (Nagin, 1999; Nagin & Tremblay, 1999). However, group-based trajectory modeling differs in two important ways. First, both hierarchical modeling and latent growth-curve analysis assume that individuals within the population follow the same general pattern of development (i.e., trajectories are continuously distributed) and are, therefore, not well-suited for identifying groups that have unique developmental patterns. Alternatively, group-based trajectory modeling does not make this assumption and, instead, takes a multinomial modeling approach and assumes that there are groups of individuals that

follow relatively similar patterns of development within the population. Second, group-based trajectory analysis does not rely on *ad-hoc,* subjective identification of groups. Group-based trajectory modeling provides *posteriori* indices that can be used to determine the identification of groups and the precision of group membership. Other methods require that groups be identified prior to trajectory identification based solely on subjective classification schemes (Nagin, 1999; Nagin & Tremblay, 1999). Thus, group-based trajectory modeling is the most ideal method for identifying groups with distinct trajectories of development.

The current study utilizes the TRAJ procedure (PROC TRAJ) in SAS which is designed to estimate developmental trajectories using data collected at multiple waves (Jones, Nagin, & Roeder, 2001). There are several steps for estimating models in PROC TRAJ. First, the procedure allows the user to model trajectories for outcomes based on three different distributions – count, binary, and psychometric data. The user must indicate which distribution would be best for modeling their specific outcome. The censored normal distribution is ideal for modeling outcomes based on psychometric scales that have finite ranges of possible scores with clustering occurring at the scale minimum and maximum. The Poisson distribution is ideal for count data in which values are censored at zero, while the binary logit is specified for data with a binary outcome (Jones et al., 2001; Nagin, 1999; Nagin & Tremblay, 1999).   The current analysis specifies a model based on a censored normal distribution. This decision was based upon visual inspection of the distribution of the outcome measure (see description of self-control in measures section above).

The next step in the analysis is to identify the best-fitting model. This is done by specifying separate models, each with a different number of groups. Within each of these different models (i.e., number of groups specified) the shape of each group's trajectory is identified. This is an iterative process in which the user specifies an order (polynomial) for each group and observes the parameter estimates to identify the best-fitting trajectory shape for each group. The PROC TRAJ procedure allows the user to specify up to third-order polynomials for time (Jones et al., 2001). Each group's trajectory can take on a constant or flat shape specified by a zero-order polynomial, a linear trajectory specified as a first degree polynomial, a curvilinear shape specified by an second order polynomial, or a cubic shape specified by a third degree polynomial. Using Nagin's (2005) approach the group that was specified as having the highest order polynomial to characterize the shape of that groups trajectory that did not reach statistical significance (i.e., $p > .05$) was adjusted (i.e., reduced). For example, if a group was specified as having a cubic trajectory shape and another was specified as having a linear trajectory yet neither had significant parameter estimates, only the group specified as having a cubic shape would be adjusted. After the order for that group was adjusted the model was then re-estimated and this process was continued until a model was specified in which all of the groups' trajectory shapes were identified as being significant (i.e., the "trimmed" model).

Once the best-fitting model for each different number of groups specified was identifiedthe Bayesian Information Criterion (BIC) was used to compare which of these models most accurately represented the data. Although the BIC provides an objective statistical approach to model selection, it is not always useful for selecting the best model and more subjective means of model selection are necessary (Nagin, 2005). As Nagin

(2005) points out, in model selection a balance is needed between objective approaches that favor parsimony and subjective interpretation that weigh the substantive meaning of the groups identified. The BIC identifies the correct model when it is maximized (i.e., less negative) and also rewards models that include fewer parameters (i.e., number of groups).

The PROC TRAJ procedure also provides a metric for evaluating the precision of group membership – the posterior probabilities – which can be used to determine the probability that an individual belongs to each group. It has been recommended that the mean of these probabilities fall above .70 (Nagin, 2005) indicating that, on average, individuals with in that group have a .70 probability of actually following that trajectory.

Statistical Formulas. The formulas presented below are those for modeling outcomes with censored normal (CNORM) distributions using group-based trajectory modeling and determining model fit. This is done in order to provide a statistical supplement to the conceptual basis for such models. In a model assuming a quadratic relationship between age and the outcome variable for individual i's age at time t given their membership in group j, the formula is:

$$y_{it}^{*j} = \beta^j_0 + \beta^j_1 \text{Age}_{it} + \beta^j_2 \text{Age}^2_{it} + \varepsilon_{it} \qquad (1)$$

where $\beta^j_{0\ldots2}$ are the parameters that determine the shape of the trajectory of each group j and, thus, are not free to vary across groups allowing each group to follow different trajectories. Age_{it} is the age of individual i at time t and Age^2_{it} is their age squared at time t and ε_{it} is the error term which is assumed to be normally distributed within the population. In the CNORM model y_{it}^{*j} is a latent variable that can be thought of as a

measure of the potential for engaging in some behavior (e.g., manifestations of low self-control).

The BIC and the posterior probabilities are common indices used for model selection the equations for each are presented below. The equation for calculating the BIC is:

$$BIC = \log(L) - 0.5*\log(n)*(k) \qquad (2)$$

where *L* is the maximized likelihood for the model, *n* is the sample size, and *k* is the number of parameters in the equation. Thus, multiplying by *k* penalizes models with more parameters.

Calculation of the posterior probability that individuals belong to a certain group can be calculated by using the following equation:

$$\dot{P}(j|Y_i) = \frac{P(Y_i|j)\hat{\pi}_j}{\sum_j^i P(Y_i|j)\hat{\pi}_j} \qquad (3)$$

Where Y_i is a vector of individual *i*'s measured behavior at each time period, *t*, and $\dot{P}(j|Y_i)$ is the estimated probability that individual *i* belongs in group *j*, given Y_i. Because it is impossible to calculate $\dot{P}(j|Y_i)$ from parameter estimates, it's value is estimated from $P(Y_i|j)$, which represents the probability that individual's *i* behavior would have been observed given membership in group *j*. Also, $\hat{\pi}_j$ is the estimated proportion of the population in group *j*. Because $P(Y_i|j)$ will inherently be inflated for larger sized groups, these values are weighted by $\hat{\pi}_j$. The mean of $\dot{P}(j|Y_i)$ can provide a useful tool for identifying the optimal model (i.e., >.70).

Developmental trajectories of self-control

The method and procedures described above were used to identify developmental trajectories of self-control. Specifically, self-control is measured at each wave of data collection and were modeled as a function of the individuals' grade at each wave. For reasons described above, the model was specified as a censored normal distribution. Selection of the order of each group's trajectory that best represents the data is informed by the statistical comparison of the parameters of each model specified as well as the theoretical basis.   The approach taken in the current study, began with the highest order possible (i.e., cubic) and to adjusted or "trimmed" the order for those groups in which the parameter estimates were not significant. Subsequent models were then specified by increasing the number of groups and trimming the model until the BIC was maximized.

In order to ensure that the best fitting model is chosen, the posterior probabilities were also examined. The posterior probabilities provide an index of the probability that each individual belongs to each group – the higher the probability the more confident one can be that an individual's trajectory has been correctly identified – and can be used to classify individuals into a certain group (i.e., the one for which they have the highest probability of belonging). Therefore, a high mean posterior probability for each group is a good indicator that the model specified best fits the data. Nagin (2005) recommends that the mean posterior probabilities be at least .70, in order to ensure certainty in group membership.

A trajectory model that identifies only one group or several groups that have the same stable pattern in their development would provide support for self-control theory. In the context of examining aggregate levels of self-control over time, the theory would be supported if several groups were identified that underlie and parallel stable mean-level

pattern of self-control. On the other hand, if distinct developmental patterns in self-control that evince change are identified or if a single trajectory that declines or increases in self-control over time is identified, then this would be inconsistent with the theory.

Identification of Risk Factors

Once the final, best-fitting model for identifying developmental patterns in self-control was identified, the group assignment for each individual (i.e., the group with the highest probability of membership for each individual) was identified. This allowed for the creation of a variable that reflects each individual's group assignment which was then used in subsequent analyses. First, an ANOVA was conducted examining mean differences for each of the risk factors across the group assignment variable. Then, a sequence of multinomial logistic regression models (MLOGITs) was conducted using STATA 11.0 software in order to examine the unique contribution of each risk factor in distinguishing group membership. Robust standard errors were used in these models in order to account for the possibility of clustering by school. First, demographic variables (i.e., gender and race) were included in the model. Second, theoretically and empirically relevant risk factors (i.e., parental characteristics, school bonds, and peer association) were included in the model.

The MLOGIT was also computed while accounting for the clustering of data within schools by adjusting the standard errors. Clustering refers to the notion that individuals within a specific context may be more similar to one another than they are to individuals in other contexts. To the extent this occurs, standard errors are inflated and can lead to inaccurate tests of statistical significance. Because individuals in the current data are nested within schools, a clustering effect may occur for those within the same

schools. To ensure this did not occur in the present analyses, robust standard errors were employed. Such an approach takes into account the nested nature of the data and allows for more accurate and proper inferences.

One issue with examining differences in risk-factors across groups after the groups have been identified (i.e., the "classify-analyze" approach) is that it does not account for the fact that there is uncertainty in group membership and can compound the reification problem (Nagin, 2005). Specifically, reification refers to the idea that identified groups actually exist and the individuals within those groups follow their respective trajectory lock-in-step. Assigning individuals to discrete groups in order to conduct further analyses assumes that the trajectory analysis has accurately identified the trajectory group to which each individual belongs. In actuality, the groups identified in the trajectory analysis are only statistical approximations of reality. However, Roeder, Lynch, and Nagin (1999) suggest that this is not as problematic when the mean posterior probabilities are high enough (i.e., $\geq .70$). Thus, the mean poster-probabilities were observed to ensure confidence in group membership and to justify including the identified groups as outcomes in subsequent analyses.

Because Gottfredson and Hirschi do not make claims about the number or nature of groups that would be identified, linking risk factors to trajectories self-control is exploratory. However, general predictions based on their theoretical claims can be made regarding the risk factors. Because Gottfredson and Hirschi suggest that parenting and to some extent school socialization are influential in the development of self-control, it is expected that those groups that follow trajectories with low levels of self-control will be more likely to experience poorer quality of parenting and have weaker school bonds than

those that follow high trajectories of self-control.   Alternatively, Gottfredson and Hirschi disregard the direct influence of race, gender, parental criminality, and deviant peers on the development of self-control. In turn, it is not expected that these risk factors will be associated with group membership.

Hypotheses

Given the preceding discussion, several specific hypotheses have emerged within the context of the current study:

Hypothesis 1: It is not expected that significant mean-level changes in self-control will be observed.

Hypothesis 2: It is expected that adjacent measurement periods will be positively correlated at or above .60.

Hypothesis 3: It is expected that only one trajectory group will be identified or that multiple groups will be identified that have constant (i.e., zero-order) shapes and only differ on mean-levels of self-control will be identified.

Hypothesis 4: It is expected that gender will not differ among groups.

Hypothesis 5: It is expected that race will not differ among groups.

Hypothesis 6: It is expected that deviant peer association will not differ among groups.

Hypothesis 7: It is expected that groups with low mean-levels of self-control will have poorer quality of mother supervision than those with high mean levels of self-control.

Hypothesis 8: It is expected that groups with low mean-levels of self-control will have poorer quality of mother attachment than those with high mean levels of self-control.

Hypothesis 9: It is expected that groups with low mean-levels of self-control will have poorer quality of father parenting than those with high mean levels of self-control.

Hypothesis 10: It is expected that parental criminality will not differ among groups.

Hypothesis 11: It is expected that groups with low mean-levels of self-control will have lower school commitment than those with high mean levels of self-control.

Hypothesis 12: It is expected that groups with low mean-levels of self-control will have lower belief in school rules than those with high mean levels of self-control.

Study Strengths and Potential Limitations

This design of the current study has several advantages. The longitudinal design over four waves of data allows for an appropriate test of the stability hypothesis. Because self-control is assessed at four time points, this allows for the identification of groups that follow unique trajectories (i.e., constant, linear, quadratic, and cubic shapes). This is an advantage over assessing stability at only two or three time points as these would restrict the extent that different developmental patterns could be modeled. The current dataset also provides information on relevant constructs for a large sample of individuals. Information on theoretically relevant constructs for the development of self-control are available such as parenting, school bonds, and peer association. Reliance on datasets that do not account for such factors may lead to mis-specified models by disregarding other important, competing factors that may influence the development of self-control. In order to increase representativeness, rural counties were over-sampled. This approach ensures that certain segments of the society (i.e., individuals who come from rural backgrounds) are not underrepresented in the current study. Ensuring that individuals from rural counties are included in the analyses increases the generalizability of the study findings and limits sampling bias. The application of the SPGM is appropriate for assessing the stability of self-control and has advantages over other methods such as

hierarchical linear modeling. The SPGM method is especially appropriate for examining change while accounting for the possibility that individuals follow different developmental trajectories.

It is also important to note some potential limitations of the current study. First, there are a few sampling issue that may bias the results and limit their generalizability. The universal sampling frame was over 9,000 students; however, due to the requirement that active parental consent had to be obtained, just over 4,000 students were enrolled. Those youth for whom active parental consent was not obtained may systematically differ from those who participate on the outcome variable of self-control as well as other risk factors (e.g., parenting). Based on the current data it is not possible to make comparisons between who did and did not participate on the variables under consideration; however, it would be possible to address this limitation if these individuals were identifiable and the relevant information was collected at the same time as the data were collected from those who are included in the sample. Thus, it will be important to interpret the results with caution. The sample was also limited to the state of Kentucky and may not generalize to the entire population.

Another limitation is that information on all potential risk factors is not available and may result in misidentified model. For example, neighborhood context has been suggested to be important in the development of self-control (Turner et al., 2005); however, information on neighborhood is unavailable in the current dataset and cannot be accounted for. Another limitation regarding risk factors is the point at which they were measured. All risk factors were measured at wave one. This limits the ability to make claims about causality regarding the risk factors predicting trajectories. This limitation is

less applicable for more static variables such as gender, race, and prior parental criminality. However, the effect of the more dynamic risk factors such as parenting, school bonds, and peer deviance must be interpreted with caution.

A final limitation applies to all studies that use SPGM as a way to model change. Nagin and Tremblay (2005) have identified three common misconceptions that can lead to a reification of the results produced from SPGM. The common misconceptions include the interpretation that individuals really belong to these groups; the number of groups produced is certain; and that those within each group follow the pattern of their respective group membership exactly. It is important to be aware of these misconceptions when interpreting the findings from the current study in order to avoid a reification of the groups identified as having a certain developmental pattern in self-control.

CHAPTER 5:

RESULTS

Mean-level analysis (absolute stability)

Figure 1. *Mean levels of self-control by grade*
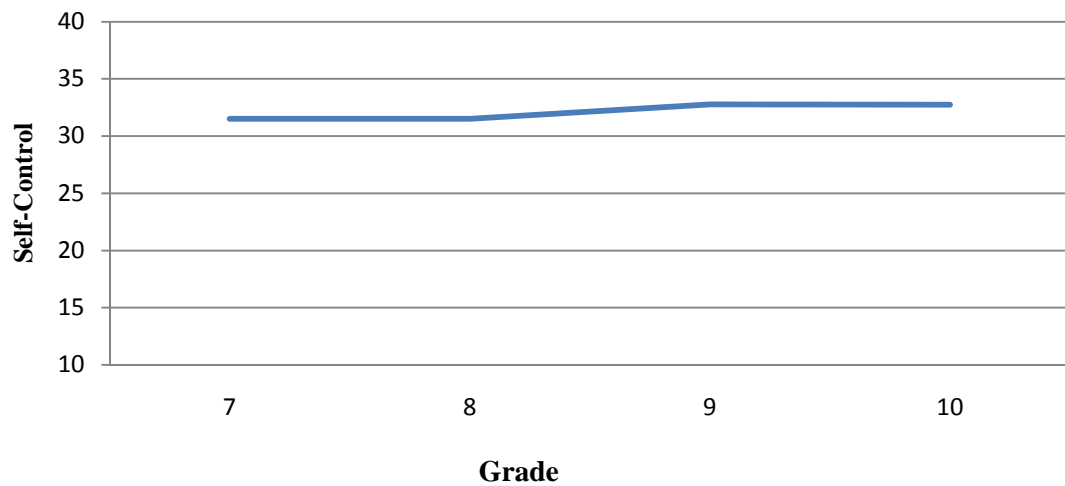
Figure 1 graphically depicts mean levels of self-control across each of the four waves. These results show that mean levels of self-control remained fairly stable over the four waves of data collection with only a slight increase. Mean levels of self-control remained constant between grade 7 ($M = 31.51$) and grade 8 ($M = 31.50$) and between grade 9 ($M = 32.77$) and grade 10 ($M = 32.75$). The most notable change occurred between grades 2 and 3; however, if this increase in mean levels of self-control is not significant it would be consistent with Gottfredson and Hirschi's notion regarding absolute changes in self-control.

Table 2. *Repeated measure ANOVAs for self-control*

			95% CI	
Comparisons	Mean Difference	*SE*	Lower Bound	Upper Bound
Grade 7 vs. Grade 8	0.43	0.13	-0.30	0.38
Grade 7 vs. Grade 9	1.11*	0.14	-1.48	-0.74
Grade 7 vs. Grade 10	1.07*	0.15	-1.46	-0.68
Grade 8 vs. Grade 9	1.15*	0.13	-1.50	-0.81
Grade 8 vs. Grade 10	1.14*	0.14	-1.50	-0.74
Grade 9 vs. Grade 10	0.04	0.12	-0.28	0.36

* $p < 0.001$

In order to assess whether these changes self-control were significant, a repeated measure ANOVA was conducted. In the current ANOVA, the assumption of sphericity was violated (Maulchy's W = .92, p<.001). Because Maulchy's W was greater than .75 (Girden, 1992), the Hyunh-Feldt was used to correct for sphericity and suggested that there were significant differences in mean levels of self-control over the four time periods ($F = 45.209$, p<.001). However, this does not indicate between which measurement periods the significant differences occurred. In order identify where the significant differences occurred, independent t-tests were examined using bonferonni correction. Table 2 reports the results from the ANOVA analysis comparing the different time points for significance. As shown in the table, self-control measured at Grades 9 and 10 were both significantly higher than that at Grade 7 and 8; however, there were no significant differences between self-control at Grade 7 and 8, nor did they differ between Grades 9

and 10. This finding does not support hypothesis 1 and is inconsistent with Gottfredson

and Hirschi's notion regarding stability.

Stability Coefficients (relative stability)

Table 3. *Correlations between self-control measured at each grade*

Self-Control	Grade 7	Grade 8	Grade 9
Grade 7	--		
Grade 8	.52	--	
Grade 9	.48	.53	--
Grade 10	.43	.48	.61

Note. All correlations significant at the *p*<.001 level.

Table 3 reports the results for the Spearman's rank-order correlations between

self-control measured at each time-point. Overall, the results show moderate to strong

correlations between measures of self-control. However, only one of the coefficients

reached the suggested level of .60 for assessing relative stability (Costa & McCrae,

1994). The correlation analyses also show that, consistent with previous research, as time

increases between measurement periods the size of the correlations tend to decrease.

Also, the correlations between time-points become stronger as individuals' age. In sum,

the correlations suggest that there is a considerable amount relative stability in self-

control; however, the correlations are not perfect and only one reaches the .60 criteria for

stability suggested by Costa & McCrae (1988). In sum, the findings from the correlation

analysis does not support hypothesis 2 and is inconsistent with Gottfredson and Hirschi's

notion regarding relative stability.

There are several potential reasons that the correlations are not as high as the theory would suggest. It is possible that there is a considerable amount of measurement error that accounts for this; however, because we do not use disattentuated correlations it is not clear if this is the reason. Another explanation is that self-control is not relatively stable for everyone and there may be some individuals who follow unique developmental trajectories of self-control. Because correlations assess relationship at the aggregate level, they may mask the identification of any such groups. Further analyses are necessary in order to test for this possibility.

Group-Based Trajectory Modeling

Model selection. In order to identify if there is heterogeneity in the development of self-control, group-based trajectory modeling was employed. As previously described, the best fitting model was identified using a number of indices (e.g., BIC, group-membership, post-predicted probabilities). The best fitting model for each model that specified a different number of groups (e.g., 1-group model, 2-group model, 3-group model, etc.) was first identified for that which the BIC was maximized (approaches zero) after trimming the order of each group (see analytic plan for details on model selection). Table 4 reports the BICs for the trimmed models where 1 – 7 groups were specified. The BIC is not reported for an 8-group model because this model would not converge. As shown in the table, the BIC continues to be maximized as the number of groups specified increases.

Beginning with the 4-group model where the BIC was maximized by trimming the orders, two stable groups were identified: a high-stable group (n = 1581; 48%; Mean GrpProb = .89) and a moderate-stable group (n = 1261; 38.4%; Mean GrpProb = .76).

Table 4. *Adjusted and Unadjusted Bayesian Information Criteria (BIC) by number of groups specified*

# of Groups	BIC (N = 3249)	BIC (N=12092)
1	-38123.20	-38125.19
2	-36774.89	-36779.49
3	-36463.65	-36469.56
4	-36394.08	-36402.63
5	-36329.33	-36343.17
6	-36306.96	-36321.42
7	-36301.77	-36316.77

There was also a group that started out with moderate levels of self-control but declined over time (n = 194; 6.2%; Mean GrpProb = .76) and a group that started with low levels of self-control but began to increase in level of self-control in the 10th grade (n = 213; 6.7%; Mean GrpProb = .81). In the trimmed 5-group model there were three stable groups: a high-stable group (n=1328; 40.2%; Mean GrpProb = .85), a moderate-high stable group (n = 1260; 38%; Mean GrpProb = .77), and a low stable group (n = 126; 4.1%; Mean GrpProb = .84). Additionally, a low-increasing group (n = 212; 7.2%; Mean GrpProb = .71) and a moderate decreasing group (n = 323; 10.5%; Mean GrpProb = .75) were identified. In addition to the BIC for the 5-group model being maximized over the 4-group model (see Table 4), a unique group is identified that follows a low-stable

pattern of development which is not identified in the 4-group model. The 5-group model appeared to be the better-fitting model compared to the 4-group model.

As shown in Table 4, compared to the 5-group model the BIC in the 6-group model was larger suggesting a better fit. More importantly, the 6-group model identified two declining groups, one of which was overlooked in the 5-group model.   The addition of this group provided substantive meaning to the model and the research question at hand (i.e. stability of self-control). Specifically, two groups were identified in the 6-group model as starting with moderate levels of self-control and declining over time. However, one group declines at a much higher rate than the other and actually switches places with those who started out lowest on self-control (see description of the 6-group model below). Although a low-stable group is not identified in the 6-group model, the groups identified in this model are substantively important as they highlight the lack of rank-order stability in self-control overlooked in previous models and when using more traditional methods. The 6-group model provides a much more insightful and nuanced picture of the stability of self-control, identifying trajectories that intersect or converge with one another not captured in the prior models. Given the current research question, the trajectories identified in the 6-group model provide substantive meaning above and beyond those identified in prior models as trajectories were identified that reflect changes in both absolute levels and the rank-order of self-control not captured in prior models.

Finally, even though the BIC is maximized in the 7-group model, the 6-group model was selected because parsimony was given priority over the BIC.   In the 7-group model, an additional group was identified that followed a high-stable trajectory of self-control, yet was only marginally higher than the high-stable group identified in the 6-

group model. Thus, the 7-group model offered no substantive contributions beyond that of the 6-group model. In turn, the 6-group model was selected as the best-fitting that identified the most meaningful groups in terms of the stability of self-control.

Figure 2: *Trajectories of self-control*
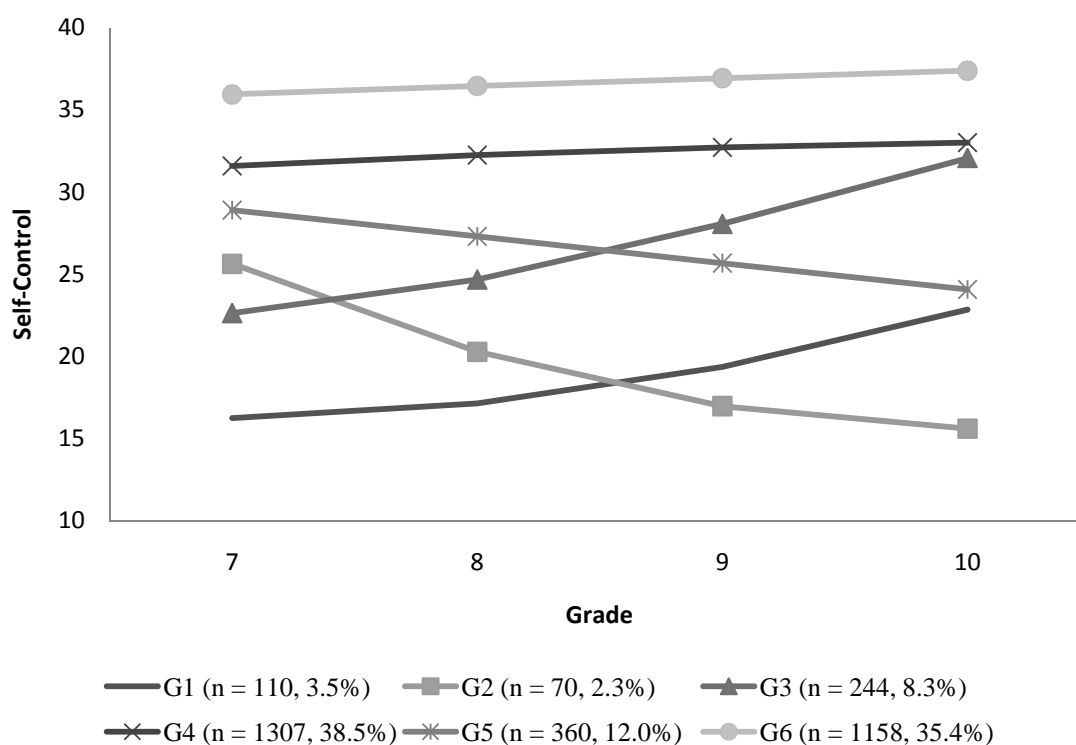
Figure 2 presents the trajectories for each of the six different groups along with the percentage of the total sample comprising each one. Group 1 is composed of 3.5% of the sample. The trajectory for this group was identified as taking on a quadratic form, starting out low on self-control and gradually increasing over time to moderate-low levels of self-control. This group was identified as the "low-increasing group". Group 2 makes up 2.3% of the sample. This group was also characterized as having a trajectory of quadratic form, beginning with moderately-low levels of self-control and then declining over time. This group was identified as the "moderate-decreasing group". Group 3 is

made of 8.3% of the sample. Individuals in this group followed a trajectory with a quadratic form, starting out with moderate levels of self-control and increasing over time. This group was identified as the "moderate-increasing group". Group 4 made up 38.5% of the sample. This group was also identified having a trajectory that was quadratic in form. Individuals in group 4 started with moderately-high levels of self-control and only slightly increased over time; thus, this group was identified as the "moderate-high stable group". Twelve percent of the sample was identified as being in Group 5. This group followed a linear pattern in development moving from moderate-high levels of self-control to moderate-low levels of self-control and was identified as the "moderate-high decreasing group". Finally, group 6 made up 35.4% of the sample and also followed a linear pattern. This group started high in self-control and slightly increased. This group was identified as the "high-stable group". Although a majority of the sample (73%) was identified as having stable trajectories, the results from the trajectory analysis are not supportive of hypothesis 3 since four of the six groups identified followed trajectories that were marked by change.

The model organizes individuals in the sample into groups using an approach that maximizes group-membership probability based on model coefficient estimates. This approach does not guarantee perfect assignment of an individual to a specific group (i.e., a probability of 1.0), but identifies the group to which individuals have the highest possibility of belonging. The model for which all individuals in the sample have been assigned to the group for which they have the highest probability is the "maximized" model (see Nagin, 2005). Table 5 reports the maximum mean posterior probabilities for the six-group model along with the number of individuals in each group. As shown, the

Table 5. *Mean and median posterior probabilities for six-group model*

Group	Prob G1	Prob G2	Prob G3	Prob G4	Prob G5	Prob G6
1 (n = 110)	.81 (.86)	.10 (.04)	.04 (.00)	.00 (.00)	.02 (.00)	.00 (.00)
2 (n = 70)	.06 (.02)	.76 (.79)	.01 (.00)	.00 (.00)	.03 (.00)	.00 (.00)
3 (n = 244)	.08 (.03)	.02 (.00)	.71 (.71)	.04 (.01)	.09 (.03)	.00 (.00)
4 (n = 1307)	.00 (.00)	.00 (.00)	.12 (.07)	.75 (77)	.14 (.08)	.17 (.13)
5 (n = 360)	.05 (.01)	.12 (.08)	.12 (.07)	.07 (.02)	.72 (.73)	.00 (.00)
6 (n = 1158)	.00 (.00)	.00 (.00)	.00 (.00)	.15 (.08)	.00 (.00)	.83 (.87)

Note. Median posterior probabilities are reported in parentheses.

mean posterior probabilities for each of the six groups are high, ranging from .71 - .83, providing confidence that individuals were assigned to the trajectory group that most accurately captures their actual trajectory. The high mean posterior probabilities also justifies the "classify-analyze" approach used in the current study to examine group differences in risk-factors by avoiding uncertainty in group membership (Roeder, Lynch, & Nagin, 1999).

Group Differences in Self-Control

In addition to identifying developmental trajectories of self-control it was also examined if the identified groups differed significantly on self-control at each time point. Table 6 reports results from one-way ANOVAs assessing mean-level differences in self-control at each time-point across groups. There were significant differences found in levels of self-control at every wave. Tukey's *b* was used to determine which groups

Table 6. *One-way ANOVAs for self-control across groups*

Self-Control	G1	G2	G3	G4	G5	G6	F	Tukey's b
Grade 7	15.85	25.81	20.80	31.39	28.71	36.55	865.96*	G6>G1 – G5; G4 > G1,G2,G3,G5; G5>G1,G2,G3; G2>G1,G3; G3>G1
Grade 8	16.47	19.96	22.96	31.47	26.90	36.79	931.02*	G6>G1 – G5; G4 > G1,G2,G3,G5; G5>G1,G2,G3; G3>G1,G2; G2>G1
Grade 9	20.11	15.80	28.97	32.81	25.25	37.96	978.41*	G6>G1 – G5; G4 > G1,G2,G3,G5; G3>G1,G2,G5; G5>G1,G2; G1>G2
Grade 10	22.16	14.80	31.91	32.81	22.70	37.85	1151.81*	G6>G1 – G5; G4 > G1,G2,G5; G3>G1,G2,G5; G5>G2; G1>G2

Note. * = $p<.001$; G1 = Group 1 (Low-increasing); G2 = Group 2 (moderate-decreasing); G3 = Group 3 (moderate-increasing); G4 = Group 4 (moderate-high stable); G5 = Group 5 (moderate-high decreasing); G6 = Group 6 (high-stable)

differed significantly at each wave. The high-stable group showed considerable relative stability maintaining significantly higher levels of self-control than any other group over the entire period. However, there were several changes in group differences on self-control over the four grades among the other five groups (see Table 6), suggesting rank-order changes in self-control. Most notable, the moderate-high stable group had significantly higher levels of self-control than group 2 in the 7th grade; however, at wave 4 these two groups shared similar levels of self-control. Also, the low-increasing group had lower self-control than the moderate-decreasing group in the 7th grade but this relationship was reversed in 10th grade. Several other changes in the rank order positioning of groups on level of self-control are captured in Table 6.

In sum, the ANOVAs revealed that a considerable portion of the sample had relatively stable (i.e., the high-stable and moderate-high stable groups) levels of self-control. However, several of the groups showed distinct, changing patterns in the development of self-control. For these groups, their levels of self-control changed enough to alter their rank-order position. These findings fail to support hypothesis 3, in that a sizeable portion of the sample evidenced considerable change in both the absolute and relative sense.

Risk Factors

Mean differences in risk-factors. The first step in examining if risk factors differed across groups was to conduct a series of one-way ANOVAs. Table 7 reports the results from ANOVAs for each risk factor separately. The results regarding gender and minority status confirm hypothesis 4 and 5, respectively. There was no significant variation in gender across groups and while there were significant differences in minority

Table 7. *One way ANOVAs examining gender, minority status, peer association, parenting, parental criminality, school bonds, and self-control by group*

	G1	G2	G3	G4	G5	G6	F	Tukey's b
Gender	.49	.54	.47	.53	.51	.56	1.89	None
Minority Status	.86	.87	.88	.90	.89	.92	2.33*	None
Peer Association	3.40	2.16	2.70	1.48	1.86	.81	34.39**	G1>G2,G3,G4,G5,G6; G3>G4,G5,G6; G2>G6; G5>G6
Parenting								
Mother								
Supervision	15.57	16.17	16.39	17.44	16.77	18.16	31.62**	G6>G1,G2,G3,G5; G4>G1,G2,G3; G5>G1
Attachment	15.41	17.32	17.59	18.79	17.78	20.30	47.32**	G6>G1,G2,G3,G4,G5; G4>G1,G2,G3; G5>G1; G3>G1; G2>G1
Father	30.32	32.53	32.97	36.12	34.99	39.52	34.60**	G6>G1,G2,G3,G4,G5; G4>G1,G2,G3; G5>G1
Parental Criminality	.44	.37	.37	.22	.29	.13	27.61**	G1>G4,G5,G6; G3>G4,G6; G2>G4,G6; G5>G6
School Bonds								
Commitment	13.60	14.62	14.95	16.37	15.66	17.35	65.11**	G6>G1,G2,G3,G4,G5; G4>G1,G2,G3; G5>G1,G2; G3>G1
Rules	17.67	18.75	18.52	19.91	19.48	21.18	28.92**	G2>G1; G6>G1,G2,G3,G4,G5; G4>G1,G3; G5>G1

Note. *p<.05, **p<.001; G1 = Group 1 (Low-increasing); G2 = Group 2 (moderate-decreasing); G3 = Group 3 (moderate-increasing); G4 = Group 4 (moderate-high stable); G5 = Group 5 (moderate-high decreasing); G6 = Group 6 (high-stable)

status, the post-hoc tests did not identify for which groups there were significant differences. Because of this, minority status could not be further examined and interpreted.

As shown in Table 7, the ANOVAs reveal significant variation in deviant peer association across groups. The findings suggest that those groups that are increasing in levels of self-control (i.e., the low-increasing and moderate-increasing groups) tend to have more deviant peer association than those that follow stable and decreasing patterns. While it is not surprising that the increasing groups have more deviant peer association than the stable groups, it is somewhat counterintuitive that they have more deviant peers association than those with decreasing patterns. However, this finding makes more sense given that both increasing groups had lower levels of self-control in 7th grade than the decreasing groups. Thus, this finding may be reflecting the association between levels of self-control and deviant peer association at grade seven only. Somewhat more intuitive is the finding that the moderate-high decreasing group had more deviant peer association than the high-stable group, suggesting that deviant peer association may be an important risk factor in differentiating those that lose self-control from those that maintain high levels of self-control. These findings lead to the rejection of hypothesis 6 that deviant peer association will not be associated with group membership.

Table 7 also shows significant differences among groups for parenting variables. In general, those with higher, stable trajectories show higher quality of parental socialization for all of its sources (father, mother supervision, and mother attachment) than those groups with lower levels of self-control with less stable trajectories. This finding is consistent with hypotheses 7 through 9; however inconsistent with Gottfredson

and Hirschi's claims, mother attachment was the only form of parenting that differentiated the low increasing group from the moderate-increasing and moderate-decreasing groups. The former finding is not surprising; however, the latter finding is somewhat perplexing. Similar to deviant peer association, this may reflect this relationship at the 7th grade assessments given that the increasing had lower levels of self-control at this time point.

As shown in Table 7, parental criminality also varied significantly across groups. With few exceptions, the findings from the ANOVAS generally suggest that those with lower, less stable trajectories in self-control report a higher degree of parental criminality than those with higher, stable trajectories. This finding is not in line with hypothesis 10 and is inconsistent with the theory indirectly suggesting support for the intergenerational or genetic transmission of self-control.

Finally, Table 7 shows that both school commitment and belief in school rules varied significantly across groups. Once again, the more stable groups with higher mean levels of self-control tended to report higher levels of school commitment and belief in school rules than those groups with lower, less stable trajectories. However, the moderate-high stable group was more similar to the less stable groups than the high-stable group on both commitment and belief in rules. These findings are consistent and supportive of both hypotheses regarding school commitment and belief in school rules (hypotheses 11 and 12). They are also in line with Gottfredson and Hirschi's (2003) more recent acknowledgment of school socialization as important in the development of self-control.

In sum, the ANOVAs suggest that the risk factors tend to differentiate those groups with higher, more stable patterns in self-control from those with lower, less stable patterns. In general, those with less stable self-control tend to be characterized by more risk-factors than those with more stable trajectories. There are some significant differences in risk factors among the less stable groups and while it appears that these differences seem to reflect the association between mean-levels of self-control and risk factors measured in the 7th grade, the veracity of this claim cannot be unequivocally verified with this data.

Multinomial Logistic Regression

        Relative differences in risk-factors across the six identified trajectory groups. In order to assess the relative importance of risk factors, three multinomial logistic regression models (MLOGIT) were conducted. In the first model, group membership is regressed onto race and gender and in the second model group membership is regressed onto race, gender, deviant peer association, parenting, parental criminality, and school bonds.

        Table 8 reports the results from the multinomial logistic regression analysis. Within the context of the current research question, it is important to identify the relative importance of factors that differentiate those with stable trajectories from those with changing trajectories. Additionally, the ANOVA analyses suggested most of the differences in risk factors are between those groups lacking stability in self-control and

Table 8. *Multinomial logistic regression: group membership by risk factors*

Variable	Model 1			Model 2		
	B	*SE*	*exp(B)*	*B*	*SE*	*exp(B)*
Gender						
Low-increasing	-.28	.22	.76	.21	.32	1.23
Moderate-decreasing	-.11	.23	.90	.27	.35	1.31
Moderate-increasing	-.39**	.15	.68	.01	.17	1.01
Moderate-high stable	-.12	.08	.89	-.04	.12	.96
Moderate-high decreasing	-.21	.11	.81	.05	.15	1.05
Minority Status						
Low-increasing	-.60	.31	.55	-.38	.24	.68
Moderate-decreasing	-.48	.36	.62	-.38	.39	.68
Moderate-increasing	-.41*	.19	.66	-.31	.18	.73
Moderate-high stable	-.05	.11	.95	.06	.13	1.06
Moderate-high decreasing	-.34*	.15	.71	-.34	.18	.71
Deviant Peers						
Low-increasing	--	--	--	.29***	.04	1.37
Moderate-decreasing	--	--	--	.18***	.05	1.20
Moderate-increasing	--	--	--	.24***	.03	1.27
Moderate-high stable	--	--	--	.13***	.02	1.14
Moderate-high decreasing	--	--	--	.17***	.03	1.19
Mother Attachment						
Low-increasing	--	--	--	-.14***	.03	.87
Moderate-decreasing	--	--	--	-.06	.04	.94
Moderate-increasing	--	--	--	-.04	.02	.96
Moderate-high stable	--	--	--	-.04*	.02	.96
Moderate-high decreasing	--	--	--	-.07**	.02	.93
Mother Supervision						
Low-increasing	--	--	--	-.01	.04	.99
Moderate-decreasing	--	--	--	-.07	.07	.93
Moderate-increasing	--	--	--	-.05	.04	.95
Moderate-high stable	--	--	--	-.02	.02	.98
Moderate-high decreasing	--	--	--	-.04	.03	.97
Father Parenting						
Low-increasing	--	--	--	-.04**	.01	.97
Moderate-decreasing	--	--	--	-.03	.02	.98
Moderate-increasing	--	--	--	-.03***	.01	.97
Moderate-high stable	--	--	--	-.02**	.01	.98
Moderate-high decreasing	--	--	--	-.02	.01	.98
Parental Criminality						
Low-increasing	--	--	--	.44**	.13	1.55
Moderate-decreasing	--	--	--	.22	.16	1.24
Moderate-increasing	--	--	--	.27*	.12	1.31
Moderate-high stable	--	--	--	.20	.11	1.22
Moderate-high decreasing	--	--	--	.26*	.12	1.30
School Commitment						
Low-increasing	--	--	--	-.29***	.05	.75
Moderate-decreasing	--	--	--	-.27***	.08	.77
Moderate-increasing	--	--	--	-.18***	.04	.84
Moderate-high stable	--	--	--	-.09**	.03	.92
Moderate-high decreasing	--	--	--	-.17***	.03	.84
School Rules						
Low-increasing	--	--	--	-.00	.03	1.00
Moderate-decreasing	--	--	--	.02	.05	1.02
Moderate-increasing	--	--	--	-.02	.02	.98
Moderate-high stable	--	--	--	-.02	.02	.98
Moderate-high decreasing	--	--	--	.01	.02	1.01
Wald χ^2 ($R^{2)}$)	26.43** (.00)			2885.33***(.07)		

Note. * = *p<.05*, ** = *p<.01*, *** = *p<.001;* Group 6 is the high-stable group and served as the reference group for all comparisons.

those with higher, stable trajectories (most differences occurring with high-stable group).

Therefore, the high-stable group is designated as the comparison group. This enables the

identification of the relative importance of risk factors in differentiating those with high,

stable levels of self-control from those with lower, less stable levels of self-control.

Model 1 of Table 8 reports differences in minority status and gender between the

high-stable group and all other groups. As shown, those in the moderate-increasing

group are more likely to be male and of minority status than those in the high-stable

group. Additionally, the moderate-high decreasing group was more likely to be of

minority status compared to those in the high-stable group. In general, however, neither

gender nor minority status were useful in distinguish group membership. This finding

confirms those regarding minority status and gender found in the ANOVAs while also

confirming hypotheses 4 and 5.

Model 2 of Table 8 reports differences in parenting, school bonds, parental

criminality, and deviant peers controlling for minority status and gender. The differences

in minority status and gender found in the first model are washed out in the second model

once other variables are taken into account. In general, the final model supports the

findings from the ANOVAs that those groups with higher, more stable levels of self-

control have fewer risk factors than those with lower, less stable trajectories. However,

once other factors are held constant, mother supervision and belief in school rules no

longer differentiate those in the high stable group from any of the other groups. The

former finding is inconsistent with Gottfredson and Hirschi and fails to find support for

hypothesis 7 that mother supervision should differ across groups. The latter finding is

also inconsistent with their more recent claims that school socialization is important in the development of self-control and fails to find support for hypothesis 12.

Deviant peer association and school commitment are the most consistent in differentiating the groups, with the high-stable group having less deviant peer association and higher levels of school commitment than all other groups. Additionally, both deviant peer association and school commitment have the strongest coefficients compared to those of other variables. The finding that deviant peer association distinguishes among these groups is inconsistent with Gottfredson and Hirschi's notion that peers do not influence one's level of self-control and, also does not support hypothesis 6. Counter to the findings regarding school rules, the finding that school commitment distinguished groups is consistent with Gottfredson and Hirschi's (2003) more recent claims about schools and their role in the development of self-control. Thus, we fail to reject hypothesis 11.

Although mother attachment, father parenting, and parental criminality were less consistent in terms of which specific groups were significantly different from the high-stable group and the magnitude of the coefficients were small, the findings still suggest that, in general, those groups with lower, less stable trajectories are associated with more risk factors than those in the high-stable group. For the most part, the lower, less stable groups tended to have lower father parenting and mother attachment and higher parental criminality than the high-stable group. However, the coefficients for mother attachment and father parenting were relatively small, increasing the likelihood that significant comparisons for these risk factors are due to chance. On the other hand, the coefficients

for parental criminality were higher, suggesting that it is might be important in the development of self-control.

Not surprisingly, the group that most consistently differed from the high-stable group across risk factors was the low-increasing group. Alternatively, the moderate-decreasing group was the only group that differed from the high-stable group on only two risk factors: school commitment and deviant peers. With the addition of having higher parental criminality, the other decreasing group (i.e., the moderate-high decreasing group) also differed on these two risk factors. Thus, it may be that these two factors (deviant peer association and school commitment) are most important in identifying those individuals that will follow decreasing trajectories in self-control. However, the finding that both increasing groups also differed from the high-stable group on deviant peer association and school commitment makes the utility of these risk factors in identifying trajectories less clear. Although it cannot be discerned from the current data, it might be the case that there are qualitative differences in the peer associations and school commitments between these groups.

In sum, the findings from the MLOGIT analysis generally support those of the ANOVAs in that several factors are identified as important in differentiating among those groups with lower, less stable trajectories of self-control from those with higher, more stable trajectories. Although these general patterns do emerge, the number of groups and risk factors examined make the results a bit unwieldy and hard to interpret. Additionally, it limits the ability to make comparisons between those groups with increasing trajectories from those with decreasing trajectories.

Relative differences in risk-factors for stable, increasing, and decreasing

groups. To limit the number comparisons and allow for the examination of what risk

factors differentiate those groups with increasing trajectories from those with decreasing

trajectories, an additional MLOGIT was conducted. In order to do so, three groups were

created by collapsing those with increasing trajectories into a single group, those with

decreasing trajectories into a single group, and those with stable trajectories into a single

group, resulting in an increasing group, a decreasing group, and a stable group,

respectively. In order to maintain consistency and make comparisons across models, the

stable group will be specified as the comparison group. This will allow for comparisons

in risk factors between the stable and decreasing groups – do risk factors differentiate

those who decrease in self-control from those who maintain high levels of self-control?;

and those between the stable and increasing groups – do risk factors differentiate those

with stable levels of self-control from those with increasing levels?

The results for the MLOGIT models examining differences in risk-factors across

the groups that were decreasing, increasing, and stable in self-control are presented in

Table 9. Essentially, minority status, deviant peers, mother attachment, and school

commitment differentiated those groups that were stable on self-control from those with

increasing and decreasing trajectories. Specifically, those who were stable were less

likely to be of minority status, have fewer deviant peers, report higher levels of mother

attachment, and school commitment compared to those with trajectories marked by

changing levels of self-control. Although gender differentiated the increasing from

decreasing groups, this effect was no longer significant when statistically controlling for

other variables. Additionally, parental criminality was significant, but only in

differentiating those who had increasing trajectories from those with stable trajectories.

Table 9. *Multinomial logistic regression examining differences in risk factors across*

increasing, decreasing, stable groups.

Variable	Model 1			Model 2		
	B	*SE*	*exp(B)*	*B*	*SE*	*exp(B)*
Gender						
Decreasing	-.12	.09	1.13	.10	.12	1.11
Increasing	-.29*	.13	.75	.10	.16	1.11
Minority Status						
Decreasing	-.34*	.16	1.40	-.37*	.18	.69
Increasing	-.45*	.19	.64	-.32*	.14	.73
Deviant Peers						
Decreasing	--	--	--	.01*	.01	.99
Increasing	--	--	--	.08**	.03	1.08
Mother Attachment						
Decreasing	--	--	--	-.04*	.02	.96
Increasing	--	--	--	-.05*	.02	.95
Mother Supervision						
Decreasing	--	--	--	-.03	.03	.97
Increasing	--	--	--	-.03	.03	.97
Father Parenting						
Decreasing	--	--	--	-.01	.01	.99
Increasing	--	--	--	-.02	.01	.98
Parental Criminality						
Decreasing	--	--	--	.12	.07	1.13
Increasing	--	--	--	.19**	.06	1.21
School Commitment						
Decreasing	--	--	--	-.13***	.02	.88
Increasing	--	--	--	-.16***	.03	.85
School Rules						
Decreasing	--	--	--	-.02	.01	.98
Increasing	--	--	--	-.00	.02	1.00
Wald χ^2 (R^2)		13.11* *(.00)			258.70***(.08)	

*Note. * = p<.05, ** = p<.01, *** = p<.00.1*

The increasing group was more likely to report parental criminality compared to

the stable group. In general, these findings support those of prior analyses in the current

study, suggesting that there are important risk factors that differentiate those who have

higher, stable trajectories of self-control from those with lower, less stable levels of self-control.

CHAPTER 6:

DISCUSSION

The current study tested one component of Gottfredson and Hirschi's self-control theory – the stability hypothesis. The theory suggests that once set, around the ages 8 – 10, one's level of self-control will remain stable throughout the life-course. Although the stability hypothesis has received empirical attention (Arneklev et al., 1998; Burt et al., 2006; Mitchell & MacKenzie, 2006; Winfree et al., 2006; Turner & Piquero, 2002), most studies have applied methods that overlook the possibility that not all individuals follow the same developmental patterns. In the current study, both the absolute and relative stability of self-control were tested using traditional approaches by applying semi-parametric group-based trajectory modeling. This approach accounts for the possibility that not all individuals follow the same patterns in development and allows for the identification of distinct developmental trajectories (Nagin, 2005). Only two studies have applied this method to examine the stability of self-control (Hay & Forrest, 2006; Higgins et al., 2009). Their findings were consistent with those of the current study, identifying stability for the majority of their samples, yet, also identifying smaller groups that were marked by change.

The current study extends prior research on this issue by examining whether important risk-factors associated with the development of self-control (i.e., race, gender, deviant peer association, parenting, parental criminality, and school bonding) varied

across the different trajectory groups that were identified. In general, stability in self-control characterized a large majority of the sample; however, several groups were identified that followed trajectories lacking stability. It was also found that risk factors other than parenting were associated with group-membership. These findings from the current study are discussed in more detail below. First, a review and summary of the findings from the different analyses are presented. Second, the implications that these findings have on Gottfredson and Hirschi's theory are discussed. Third, some practical implications stemming from the current study are offered. Finally, the limitations of the current study and directions for future research are addressed.

Summary of Findings

Traditional approaches for assessing the stability of self-control in the current study identify a lack of stability. Mean-level analyses (i.e., repeated measure ANOVAs) revealed that there was a significant increase in self-control between the grades 9 and 10. These significant increases in self-control are inconsistent with Gottfredson and Hirschi's notions of stability. Although, Gottfredson and Hirschi may allow for a slight gradual increase in self-control is consistent with their notion that everyone will increase in self-control over time due to continued socialization, it would not be expected that these increases would be significant.

Contrary to Hirschi and Gottfredson's position, most researchers have interpreted the stability hypothesis as one of relative stability, which cannot be assessed with mean-level analyses, and instead require the use of stability coefficients (e.g., Mitchell & McKenzie, 2006; Winfree et al., 2006; Yun & Walsh, 2010). This study also applied the use of stability coefficients in the current sample, which were fairly consistent with prior

research. As with prior research, the majority of the coefficients (r's = .43 - .61) did not

reach the magnitude suggested to be indicative of relative stability (Costa & McCrae,

1988). Based on these results, it is unclear why the stability coefficients were not higher.

One possibility is that measurement error accounts for a lack of relative stability reflected

in the correlations. Another possible explanation is that the theory is wrong in that self-

control is not entirely stable. However, another possibility that is at odds with

Gottfredson and Hirschi's claims about stability is that there is heterogeneity in

developmental patterns of self-control.

  Despite being a widely used method for assessing stability, both ANOVAs and

stability coefficients are aggregate measures of stability and, therefore, overlook the

possibility that not all individuals follow the same developmental patterns in self-control.

The current study extended prior research assessing the stability of self-control by using a

semi-parametric group-based modeling (SPGM) strategy to account for the possibility

that there is heterogeneity in developmental patterns of self-control.

  For the most part, the results from the SPGM are consistent with those of the

ANOVAs and correlations. Self-control appeared to remain stable for the two largest

groups which represented a majority of the sample (n=2465, 73.9%). However, several

groups were also identified that followed developmental trajectories for which self-

control was not stable. While these groups combined to make up a smaller portion of the

sample, they were not trivial in size (n = 704, 26.1%).

  In all, six distinct developmental trajectories of self-control were identified – two

groups that were stable, two groups that increased, and two groups that decreased in self-

control over the four year period. The two stable groups were higher on self-control than

the other four groups, and both stable groups changed at the same rate; however, one group had a higher mean-level than the other. Both of the increasing groups started out having the lowest and second lowest mean levels of self-control than the other groups and increased at the same rate as each other. The decreasing groups both started out having moderate levels, one slightly lower than the other, of self-control, yet, one decreased at a higher rate than the other.

The SPGM models also revealed that several of the trajectories associated with the identified groups intersected with one another. This finding is also consistent with those of Hay and Forrest (2006) and Higgins et al. (2009) and provides evidence for rank order changes in levels of self-control over time for some of the identified groups. That is, while most of the sample maintained their respective rank-order, there were some groups that did not. This interpretation is supported by the results from the ANOVA analyses examining mean differences in self-control across groups over time. From the ANOVAs, it was observed that mean differences in self-control between groups were not consistent over the four grades. Some groups were actually higher on self-control than others at grade seven assessments, but were lower than the same group/s at grade ten assessments. These changes in mean-level differences in self-control between groups over the four year period are evidence that self-control is not relatively stable for some groups and that rank-order changes do occur.

The next step of the analyses was to identify what factors might be associated with fluctuations and/or stability in self-control. This was carried out using ANOVAs and MLOGITs. The results from the ANOVAs identified several unique differences across the groups. The general pattern of findings suggest that those groups with less

stable trajectories tend to have more risk factors compared to groups that have more stable trajectories.

The findings from the ANOVA also underscore the uniqueness of the groups identified in the trajectory models. For example, significant differences were found between the low-increasing and moderate-increasing groups on both school commitment and mother attachment. Similarly, the high-stable and moderate-high stable groups differ significantly on several risk factors, including mother attachment, school commitment, school rules, and father parenting. The moderate-high decreasing group was also found to have significantly higher levels of school commitment than the moderate-decreasing groups. These differences in risk factors suggest that the groups identified in the trajectory analysis are distinct in that they have unique relationships with the risk factors.

In order to identify the relative importance of risk factors, an MLOGIT was conducted. The results from the MLOGIT were consistent with the ANOVA, revealing that those groups with lower, less stable trajectories were more likely to experience inadequate parenting, have poor school commitment, be exposed to peers who engage in a variety of delinquent behavior, and have parents with a criminal history, compared to those in the high stable group.

In order to examine if risk factors distinguished more general patterns of development, those groups that followed similar patterns were collapsed into three different groups – increasing, decreasing, and stable. Using MLOGIT analysis, it was examined if the same risk-factors distinguished these groups. The results suggested that minority youths with moderate levels of self-control who associate with deviant peers, lack commitment to school, and feel unattached to their mother are more likely to

experience instability in self-control compared to those who maintain high levels of self-control, a result underscored in the prior MLOGIT analysis.

Implications for Theory and Research

The results of the current study have important theoretical implications for both theory and research regarding the stability of self-control. The findings suggest that Gottfredson and Hirschi's contentions are incorrect and suggest that the theory needs to be modified to account for the empirical finding that self-control is not stable in the absolute or relative sense.

The findings of the current study are consistent with prior research identifying a lack of stability in self-control (Burt et al., 2006; Mitchell & McKenzie, 2006; Winfree et al., 2006). More importantly, they are consistent with those of prior research employing group-based methods to assess the stability of self-control (Hay & Forrest, 2006; Higgins et al., 2009) and similar traits such as impulsivity (Cote et al., 2002) and aggression (Johnson et al., 2007; Schaeffer et al., 2003). Similar to the current study, these studies found that the majority of individuals in their samples followed normative patterns of development (i.e., decreases in aggression and impulsivity and increases in self-control). However, these studies consistently identified smaller, yet non-trivial, groups that followed unique developmental trajectories – with both increasing and decreasing trajectories identified.

Based on the current study and prior research it can be concluded that the theory needs to be modified in a way that accounts for the possibility that some individuals do not follow the same developmental patterns in self-control. The fact that there are any individuals that demonstrate unique developmental trajectories is inconsistent with what

the theory would suggest. The empirical evidence tends to suggest that some individuals may begin to acquire self-control much later, as evidenced by the low-increasing group found in the current study. The current study and the two prior studies (Hay & Forrest, 2006; Higgins et al., 2009) that employed trajectory analysis to model the stability of self-control find similar portions of individuals who evince patterns of change in the development of self-control. Together, these studies suggests that some may begin developing self-control as early as other groups, yet do so at a much slower rate as evidenced by the moderate-increasing group. However, it is important to note that the time frame of the current analysis was only four years, which may not be sufficient to fully capture developmental trajectories. As such, the notion of differences in developmental patterns is only speculative at this point. More research is needed that begins examining the development of self-control much earlier and ends much later in the life course.

It is also of importance to understand why some individuals might not begin to develop self-control until much later or develop self-control at a much slower rate. Drawing from theoretical explanations of offending trajectories, it may be that these unique developmental patterns are marked by differences in neurological or psychological deficits that occur early in the life course (Moffitt, 1993). Research has also suggested that differences in the development of self-control can be linked to genetic factors (e.g., Beaver et al., 2008). Such deficits may hinder, but not completely halt, the development of self-control. More research is needed that directly examines the link between the early existing deficits and differences in developmental trajectories of self-control.

It is also important to address the finding that some individuals experienced losses in self-control. This finding is somewhat surprising given that Gottfredson and Hirschi were fairly adamant that self-control could not be lost once acquired. Although this finding may be partially attributable to measurement error, the size of the groups decreasing in self-control are large enough to suggest that this not a trivial finding. Additionally, decreasing trajectories have been corroborated in prior research using group-based methods (Hay & Forrest, 2006; Higgins et al., 2009) and the percentages of individuals evincing decreases in the development of self-control (12 – 16% of the samples) are similar across these studies providing more confidence in this finding. One possible explanation can be drawn from Baumeister, Heatherton, and Tice (1994). They developed the self-regulatory strength model, suggesting that the self-regulatory process, a concept similar to self-control, is analogous to a muscle and can become fatigued after periods of continued use. While this has been tested and supported in laboratory experiments, it has not been examined in field experiments. However, this concept may be extended to the idea that long-term stressful environmental circumstances (e.g., family, neighborhood, and school) can place undue strain on ones capacity for self-control and result in declines in self-control over longer periods of time.

Although the exact nature (e.g., number, shape, and size) of the trajectory groups identified vary across studies employing group-based methods, they consistently identify groups with distinct developmental trajectories of self-control (Hay & Forrest, 2006; Higgins et al., 2009). These findings underscore the potential for more traditional methods of assessing stability to overlook heterogeneity in developmental patterns of self-control. Thus, it may be necessary for research examining the stability of self-

control, and research on self-control in general, to employ methods that can account for this heterogeneity (e.g., Blonigen, 2010).

The findings of the SPGM are also in direct contrast to Gottfredson and Hirschi's claim that those individuals lowest on self-control will remain the lowest and, in turn, will always be responsible for a disproportionate amount of crime. This notion suggests that there are no typologies of offenders (e.g., chronic, late-onset, non-offenders) and that there are only two distinct groups: offenders (those low on self-control) and non-offenders (those high on self-control). However, the findings of the current study are more consistent with research that has identified unique offending trajectories (e.g., Blokland & Nieuwbeerta, 2005; Chung et al., 2002). In general, this research identifies four to six different offending groups (e.g., non-offending, adolescent-limited/late-onset, chronic). It is possible that the trajectories of self-control map onto these groups that are typically identified. For example, groups that follow high-stable trajectories of self-control may be consistent with the non-offending groups. The groups decreasing in self-control may also underlie the adolescent-limited or late-onset offending groups and the increasing self-control groups are consistent with groups characterized by desistance. It is less clear what self-control trajectory might parallel the chronic offending group. More research, however, is needed that directly links developmental trajectories of self-control to offending trajectories to better understand how trajectories of self-control are associated with offending trajectories.

The results from the MLOGITs also have important implications for both theory and research. These findings suggest that factors other than parenting distinguish among different developmental trajectories of self-control. Although causal order is not

established in the current study, these findings do suggest that deviant peer association and school commitment are associated with the development of self-control. Additionally, the findings suggest that these factors have an impact on levels of self-control past the age that Gottfredson and Hirschi suggest that they no longer would.

The finding that sources of socialization other than parenting are responsible for the development of self-control provides support for the social causation model. Briefly, the social causation model suggests that social factors can influence offending and development. However, this finding is in direct contrast to Gottfredson and Hirschi's notion of parenting as the primary source of self-control and that self-control is unresponsive to any socialization past the ages 8 – 10. The findings of the current study suggest that both school commitment and deviant peer association are associated with certain developmental patters. These findings are in line with prior research indentifying socializing agents, including those other than parenting, that impact one's level of self-control beyond ages 8 – 10 (e.g., Burt et al., 2006; Hay & Forrest, 2006; Meldrum, 2008). Thus, it is quite possible that these risk factors do influence the development of self-control.

While this may be possible, the potential dynamic nature of these risk factors limits the ability to make claims about their relationship with levels of self-control over time. As previously mentioned, the current analyses do not allow for making causal statements about the relationship between group membership and risk factors. Thus, an alternative explanation, and one more consistent with the theory, is the social selection model. In contrast to the social causation model, the social selection model suggests that an individual's criminal propensity influences their social relationships. As such, any

relationship between social factors and offending is spurious. It may be that because individuals have lower levels of self-control, they are more likely to associate with deviant peers and have fewer concerns about long-term educational goals. Previous research offers support for social selection and causation models (Wright, Caspi, Moffitt, & Silva, 1999); it may be the case here that both processes are occurring as well.

Another more static risk factor found to be important in differentiating among the identified groups was parental criminality. It was found that the low-increasing group, moderate-increasing group, and moderate-high decreasing group were more likely to have a parent with a criminal history than the high-stable group. It was also found that having a parent who had been to jail or prison distinguishes those groups with lower yet increasing levels of self-control from the high-stable group, but did not distinguish between those groups with decreasing levels of self-control from the stable group. This finding is somewhat perplexing in that it suggests that having a parent who had been to jail or prison is likely to result in an increase in levels of self-control over time. For the most part, previous research suggests that parental imprisonment has a negative impact on children (see e.g., Parke & Clarke-Stewart, 2003); however, one possibility is that the relationship between the child and the parent before legal intervention was poor and the incarceration of the parent resulted in a more stable environment, conducive to the proper development of the child (Katz, 2002). This may be the case if the children were placed with others who provided better parenting upon the incarceration of the parent, or that the incarceration resulted in the removal of a parent from the home who had a negative impact on the child's development. Although parental criminality is more static than the other risk-factors included in the analyses, it is important to keep in mind that this

variable does not capture undetected parental criminality and does not reflect those that may have had criminal justice contact after the first measurement period. Furthermore, it could also be the case that the participants were unaware of their parent's previous incarceration. These caveats should be considered.

It was also found that deviant peer association distinguished those with unstable trajectories from those with higher, more stable trajectories of self-control. This finding is inconsistent with Gottfredson and Hirschi's claim that one's development of self-control is unaffected by the types of peers that individuals associate with. It should be noted that the current analyses do not allow for causal statements to be made, and, therefore, it is unclear if deviant peers are responsible for changes in self-control or if one's level of self-control influences with whom one chooses to associate with. However, prior research has found evidence that peer association does, in fact, influence the development of self-control (e.g., Burt et al., 2006).

In sum, the current study findings refute many of the theoretical claims as stated by Gottfredson and Hirschi regarding the stability of self-control. They also hint at the idea that there are different sources that influence the development of self-control, which, again, is inconsistent with Gottfredson and Hirschi. Future efforts that more directly assess the sources of self-control, and the influences on its development, need to be undertaken.

Implications for Policy and Practice

The current study also has several important implications for policy and practice. First, they provide insight into the timing of intervention. Second, they address the utility of self-control as a risk factor itself for later offending. Third, the identification of risk

factors that distinguish different trajectories of self-control provides a useful tool for identifying which youth may be most at risk for later offending. Also, the identification of these risk factors provides direction for programs regarding what life domains might make effective targets for programs designed help youth develop self-control. Each of these implications is elaborated below.

In general, the results suggest that self-control is malleable for some individuals beyond the ages of 8 – 10, especially for those lowest on self-control. These findings suggest that programs similar to those that have been found to be successful in promoting self-control and reducing later delinquency among children ages ten younger (Piquero et al., 2010) may also be effective in promoting the development of self-control and reducing offending among even older adolescents. This also appears to be the case for those individuals who are of most concern for the criminal justice system – those lowest on self-control. More specifically, the findings suggest that those with more moderate levels of self-control are at higher risk for late-onset offending, at least to the extent that their offending is due to a lack of self-control. Therefore, while it may be that programs have success in promoting self-control among even those with the lowest self-control, it is important for these programs to not overlook those with more moderate levels of self-control that are at-risk of decreasing in self-control over time (see discussion above).

As a result of the current study finding that self-control is not relatively stable (i.e., changes in rank-order positioning), the utility of self-control as a risk factor for offending is somewhat limited for specific subgroups. For example, those lowest on self-control at age 13 may not be the lowest at age 16 and, in turn, may no longer be the most prone to offending during the later years of adolescence. Accordingly, those youth who

evince higher levels of self-control early in adolescence may end up being the lowest on self-control in later years. Thus, it may not be completely accurate to identify youth as being at high risk for later offending based on their level of self-control at age ten.

Risk factors found in the current study to distinguish between those with higher, more stable trajectories from those with lower, less stable trajectories may be useful to those responsible for treatment and prevention in the identification of youth who might be most at-risk for offending. The current study also offers some direction for programs by identifying factors that might be associated with fluctuations and/or stability in self-control. The results identify several factors associated with trajectories of self-control suggesting that there are multi-determinates of how one's self-control develops. This suggests that a multisystemic approach may be most effective in promoting the positive development of self-control. A multisystemic program would account for the various potential factors affecting the development of self-control and target multiple life domains in order to increase chances for success (Borduin et al., 1995).

Although not empirically addressed in the current study, another possibility is that these risk factors interact with self-control to either promote or prevent offending. Previous research has suggested that prosocial and antisocial ties have the greatest impact in reducing and increasing offending, respectively, among those low on self-control (Wright et al., 1999). Additionally, crime prevention efforts, such as deterrence, are most effective in reducing offending among those with low self-control (Wright, Caspi, Moffitt, & Paternoster, 2004). Thus, programs that create buffers from offending (e.g., prosocial ties) and limit antisocial influence (e.g., deviant peers) may be effective in reducing offending behavior among those lowest in self-control.

Whether programs are designed to reduce offending by promoting the development of self-control or by creating buffers from offending, the current study suggests that interventions that focus on promoting proper parenting, creating school-based programs that increase educational investment, and creating prosocial activities for peer groups may be most effective in reducing offending.

Limitations

The findings from the current study must be considered in light of several important limitations. A few limitations of the current study may limit the representativeness of the sample. First, the target sample was much larger than the final sample size due to a lack of active parental consent. While it is impossible to determine the characteristics of those that did not participate in the study, it is concerning that they may have not participated for reasons that could bias the results. Most relevant to the current study is if non-participation was due to levels of self-control. It is quite possible that parents did not supply consent due to lacking self-control. However, it may also be that parents did not consent because they were concerned about their child's involvement in the study (e.g., taking away from academics, psychological well-being, etc.) which would reflect high levels of self-control. In either event, it is impossible to empirically state why some parents did not provide consent. More concerning, however, is that those individuals not included in the current analyses due to having too few measurements of self-control were found to differ significantly on several key study variables. It is especially troubling that those not included were lower on self-control. Thus, the results from the current study may be somewhat biased. However, if these individuals were included in the sample it is likely that they would have contributed to those groups lower

on self-control, either increasing the size of the currently identified groups or revealing more variation in the number of groups.

A second limitation contributing to a lack of representativeness in the sample concerns its racial, ethnic, and social class/economic status. While the current sample may be reflective of the population in Kentucky, the findings may not generalize to other geographic regions or the entire adolescent population. For example, the development of self-control has been found to vary across categories of race and ethnicity (Turner & Piquero, 2002; Winfree et al., 2006); thus, the current study findings may not generalize to the entire population given the racial, ethnic, and class homogenity of the sample used in the current study. Additionally, the current study dichotomized race into two categories and did not inquire about ethnicity (e.g. Hispanic/Latino). Assessing race in this way may overlook distinct racial and ethnic differences in self-control that may exist. However, given the racial homogeneity of the current sample, more nuanced racial categories may have been too small to capture much variation in self-control.

The current study is also limited in the measurement of several key concepts and variables included in the analyses. All measures are based on self-report and are subject to all the limitations that self-reports suffer (e.g., recall, honesty, etc.). Other sources may provide more validity in measurement than relying solely on self-reports – especially in measuring a construct like self-control in which individuals who lack self-control may have trouble providing accurate insight into their own behaviors and attitudes. Another measurement limitation is in regards to measuring race/ethnicity (discussed above).

Another limitation of the current study is that self-control was observed over a somewhat homogenous developmental period – adolescence. The current study does not

capture important developmental transitions such as those from early childhood to adolescence or adolescence to young adulthood. Extending trajectories over a longer period of time may reveal more important transitions in the development of self-control and provide a better picture of how stable (or not) self-control is over different developmental periods. Additionally, the theory contends that levels of self-control should vary considerably among the childhood years of development and that the socialization occurring during this time period is of key importance in shaping its development (see e.g., Vazsonyi & Huang, 2010). Failure to account for how self-control develops during this key period of life my overlook how early developmental patterns influence developmental patterns in adolescence.

Although several key factors relevant to the development of self-control were identified, there may be several that were not specified in the current study. For example, one potential factor that may vary across different developmental trajectories of self-control is neighborhood context. Previous research suggests that neighborhood context has an impact on the development of self-control (Pratt, Turner, & Piquero, 2004; Teasdale & Silver, 2009; c.f., Gibson et al., 2010). Unfortunately, neighborhood variables were not available in the current study. Several other relevant risk factors may be important in differentiating groups with distinct developmental trajectories of self-control not included in the current study (e.g., victimization, abuse, neurological deficits). Future research is needed that examines how these other factors impact the development of self-control. Another limitation of the current study is that trajectories of self-control were not linked to offending patterns. Given the proposed link between self-control and

offending behavior, future research should also consider the link between developmental patterns of self-control and offending patterns.

Another limitation is that aside from race, gender, and parental criminality, causal order cannot be established between risk factors and developmental trajectories of self-control in the current study. The risk factors in the current study are also assumed to be static. However, several of the risk factors are likely dynamic in nature, such as peer association, parenting, and school bonds. This potential variation in risk factors is not taken into account in the current study. Future research should examine the development of self-control as a process and account for the interaction, mediating, and reciprocal effects among these factors in order to truly understand the development of self-control. Future research, however, is needed that accounts for the dynamic nature of peer associations in order to establish if deviant peer association fluctuates with levels of self-control. Research is also needed that establishes causal order between self-control and deviant peer association. From the current study it cannot be stated whether individuals gain/lose self-control and then select out of/into deviant peer groups or if deviant peer associations precede losses in self-control. It is also likely that this process is much more complex. For example, it may be that parenting influences deviant peer association through self-control or that parenting and deviant peer association both have direct effects on self-control (Brown, Mounts, Lamborn, & Steinberg, 1993). Nonetheless, these factors may be important areas of focus for both future research and policy. Research is needed that untangles how each of these factors are related to the development of self-control and how each of these contribute to offending. Such research may inform the

development of more precise interventions aimed at increasing levels of self-control that may, in turn, reduce offending behavior.

Another limitation is in regards to the approach taken in the final MLOGIT in which the six identified groups were collapsed into three groups. This approach potentially undermines the results of the SPGM in that it suggests that a 3-group model is a more appropriate fit than the identified 6-group model. This approach was taken in order to create substantively meaningful contrasts not available from the MLOGIT that compared all groups to the high-stable group. It would be possible to run an MLOGIT using each group as the comparison; however, this would produce a somewhat unmanageable set of results. Thus, the current approach in which the groups were collapsed was done for the sake of parsimony and ease of interpretation. Additionally, the results across the 6-group and 3-group MLOGITs were similar, and, therefore, provided justification for taking this approach.

It is also important to note the limitations of the current measure of self-control. Mainly, the items included in the current measure do not capture all six components of self-control as outlined by Gottfredson and Hirschi. The items used in the current study appear to capture only the impulsive and/or temper elements of self-control. Additionally, the use of self-reports to measure self-control may be biased as individuals lowest on self-control may be more likely to respond inconsistently or inaccurately. A multi-method approach may provide a more valid indicator of self-control, such as using mother and/or teacher reports along with self-reports.

Finally, it is important to address the issue of "reification" when using group-based trajectory modeling. Essentially, reification is the inclination to refer to the

identified groups as something that actually exist and to view those individuals identified as belonging to groups to follow the trajectories lock-in-step. This issue has been raised as a concern on several occasions within the literature (e.g., Nagin, 2000; Nagin, 2005; Nagin & Tremblay, 2005; Raudenbush, 2005; Sampson & Laub, 2005). While the method itself presents a clear concern regarding the interpretations of what is a group and the implications that these groups have for both theory and policy, it is less a methodological issue than one of interpretation by the researcher. Thus, it rests in the hands of the researcher using this method to be aware of this issue and explicitly provide caution to readers that these groups are only statistical approximations of the heterogeneity in development that might actually exist. While the posterior probabilities reported in the current study suggest a considerable degree of confidence that individuals have been correctly identified as belonging to their respective groups, it must be kept in mind that there may be unidentified variation within groups and that these groups only roughly estimate the degree of heterogeneity that exists.

CHAPTER 7:

CONCLUSION

The current study was only the third study to account for the heterogeneity in the development of self-control. More importantly, this study expanded on the prior two studies through the examination of certain risk factors and whether or not they differentiated those who followed one trajectory from those who followed another. Despite the limitations of the current study, the findings provide important insights into the development of self-control. Essentially, the currents study findings invalidate the stability hypothesis set forth by Gottfredson and Hirschi. It was found that self-control is not stable for everyone and this is the case for both relative and absolute stability. It was also found that certain factors identified in the current study lead to different developmental patterns of self-control. Although it is not clear from the current study what the actual process is regarding the relationship between these factors and the development of self-control it is clear that these risk factors vary across the different trajectories – factors other than parenting.

As reviewed above, prior research has been not favorable toward the theory as a whole and its major propositions. In general, research does not support the claims that the theory makes with regards to the unidimensionality of the construct, the factors responsible for the development of self-control, its association with crime and delinquency – both its explanatory power and as the sole explanation of crime, as well as

the stability of the construct. The current study findings are in line with the existing body of literature suggesting that self-control is not stable beyond the ages that Gottfredson and Hirschi contend it will become set. Combined with the existing body of literature on self-control, the current study findings suggest that, at the very least, the theory needs to be reformulated. Additionally, the current study findings combined with the empirical status of Gottfredson and Hirschi's theory have implications for criminology as a whole.

Based on empirical tests of other propositions of the theory, a reformulation might begin with reevaluating the contention that individuals are born with hedonistic values and that everyone must acquire self-control in order to become law-abiding citizens. We do not have to look far to find alternative perspectives regarding the natural tendencies of humans from birth (e.g., Kilpinen, 1999; Mansbridge, 1990; Miller, 1999; Sen, 1977; Veblen, 1898). Similarly, the factors responsible for the development of self-control may need to be reconsidered. Research continues to suggest that other social factors (e.g., Turner et al., 2005; Burt et al., 2006) and biological factors (e.g., Beaver et al., 2008' Beaver et al., 2009) influence one's level of self-control. Research also suggests that self-control is not the sole explanation of crime, that other variables matter, and that it may interact with other theoretical constructs such as social learning variables to explain antisocial behavior (Pratt & Cullen, 2000). Research needs to continue to examine how these unique constructs work together to result in crime in order to gain a more thorough understanding and better explain its existence. From there the theory can be reworked to make more precise statements about the phenomenon of crime.

The current body of literature, including the current study, also suggests a more critical approach be taken toward the general theory. The theory has, at best, received

only "partial support." Scientific principles suggest that there is no such thing as partial support. If a theory does not receive full support it should be rejected. By these criteria, self-control and its many propositions should be discarded. This has wider implications for the discipline of criminology as a whole. While the idea of a single, simple explanation of crime and delinquency is attractive from both a theoretical and practical standpoint, criminologists need to recognize that the phenomenon of crime is much more complicated than self-control theory contends. Although the construct of self-control appears to be one factor in explaining crime (Pratt & Cullen, 2000), its role in crime is not in line with the theoretical propositions laid out by Gottfredson and Hirschi. Despite a continued lack of support for the theory, researchers continue to exert time and energy into testing the propositions of the theory as laid out by Gottfredson and Hirschi. This is a major set-back to the discipline of criminology as a whole. In order to advance the discipline, researchers must let go of the propositions made by many theories that have time and time again been disproved, take from the existing theories what has been found to be fruitful, and build from there.

CHAPTER 8:

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APPENDIX A:

LIST OF MEASURES

Self-control
1. I have difficulty remaining seated at school.
2. I get very restless after a few minutes if I am supposed to sit still.
3. When I am angry, I lose control over my actions.
4. I have difficulty keeping attention on tasks.
5. I get so frustrated that I feel like a bomb ready to explode.
6. Little things or distractions/interruptions throw me off.
7. I'm nervous or on edge.
8. I can't seem to stop moving.
9. I don't pay attention to what I am doing.
10. I am afraid I will lose control of my feelings.

Mother Attachment
1. My mother seems to understand me.
2. My mother helps me with my homework.
3. My mother makes me feel wanted.
4. I share my thoughts and feelings with my mother.
5. I do things (example: watch TV, go to sports events, go to dinner, and so on)
with my mother.

Mother Supervision
1. My mother knows where I am when I am away from home.
2. My mother is concerned with how I am doing in school.
3. My mother knows who I am with when I am away from home.
4. My mother sets a time for me to be home at night.
5. My mother makes rules that seem fair to me.

Father Parenting
1. My father seems to understand me.
2. My father helps me with my homework.
3. My father makes me feel wanted.
4. I father my thoughts and feelings with my mother.
5. I do things (example: watch TV, go to sports events, go to dinner, and so on)
with my father.
6. My father knows where I am when I am away from home.
2. My father is concerned with how I am doing in school.
3. My father knows who I am with when I am away from home.

4. My father sets a time for me to be home at night.

5. My father makes rules that seem fair to me.

Belief in School Rules

1. Students have a say in making school rules.

2. Everyone knows what the school rules are.

3. The school rules are fair.

4. The punishment for breaking school rules is the same for all students no matter who you are.

5. The school rules are strictly enforced.

6. If a school rule is broken, students know what kind of punishment will follow.

7. The teachers keep order in the classrooms.

School Commitment

1. I care a lot what my teachers think of me.

2. Getting an education is important to me.

3. I look forward to coming to school most mornings.

4. I would quit school now if I could.

5. Most of my classes are a waste of time.

Deviant Peer Association

Out of those closest friends – How many of them have done any of the following things in the present school year?

1. Smoked marijuana.

2. Cut school completely.

3. Driven after drinking.

4. Been suspended from school.

5. Taken a gun to school.

6. Taken an explosive to school.

7. Taken a weapon to school (knife, brass knuckles, and so on, other than gun or explosive).

8. Gotten arrested.

9. Sold marijuana or other drugs.

10. Stolen someone's money or property when they were not around.

11. Physically attacked someone (e.g., punched, slapped, kicked).

12. Vandalized public or private property (e.g., destroyed property, graffiti, and so on).