Published in final edited form as:

J Youth Adolesc. 2019 January ; 48(1): 43–55. doi:10.1007/s10964-018-0921-7.

Structural Home Environment Effects on Developmental Trajectories of Self-Control and Adolescent Risk Taking

Christopher Holmes, PhD,

Center for Family Research, University of Georgia, 1095 College Station Road, Athens, GA 30602-4527

Alexis Brieant, MS,

Virginia Tech

Rachel Kahn, PhD,

Sand Ridge Secure Treatment Center

Kirby Deater-Deckard, PhD, and

University of Massachusetts, Amherst

Jungmeen Kim-Spoon, PhD

Virginia Tech

Abstract

Extant literature has demonstrated that self-control is critical for health and adjustment in adolescence. Questions remain regarding whether there are individuals that may be most vulnerable to impaired self-control development and whether aspects of the structural home environment may predict membership in these subgroups, as well as the behavioral consequences of impaired self-control trajectories. The present study utilized growth mixture modeling and data from 1,083 individuals (50% female, 82% White) from age 8.5 to 15 years to identify four latent classes of self-control development. Additionally, higher household chaos and lower socioeconomic status at age 8.5 were associated with maladaptive trajectories of self-control at

telephone 1-706-583-2523; Chris.Holmes811@gmail.com.

Authors' Contributions

CH conceived of the study, participated in its design, performed the statistical analyses and drafted the manuscript; AB performed statistical analyses, edited the manuscript, and substantially contributed to the revisions of the manuscript; RK participated in the design of the study and helped to draft the manuscript; KDD conceived of the study, participated in the design and interpretation of the data, and edited the manuscript; JKS conceived of the study, participated in the design and interpretation of the data, and edited the manuscript. All authors read and approved the final manuscript.

Conflicts of Interest

The authors report no conflict of interests.

Compliance with Ethical Standards

Ethical approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent

Informed consent was obtained from all individual participants included in the study.

Data Sharing Declaration

The datasets generated and/or analyzed during the current study are available from the Study of Early Child Care and Youth Development within the National Institute of Child Health and Human Development at <https://www.icpsr.umich.edu/icpsrweb/ICPSR/series/00233>.

ages 8.5 through 11.5. In turn, maladaptive self-control trajectories at ages 8.5 through 11.5 were associated with higher risk taking at age 15. The results highlight the importance of increased structure and support for at-risk youth.

Keywords

SES; Household chaos; Self-control; Risk taking; Adolescence

Introduction

Early development of self-control has widely been considered to be of central importance to health and well-being. Developed out of their general theory of crime, Gottfredson and Hirschi (1990) attributed a considerable amount of importance to self-control for unhealthy adjustment outcomes. Although not completely deterministic, they specifically demonstrated that low self-control is a key indicator of deviance and crime. More recently, low self-control has been linked to a host of behavior problems in childhood and adolescence (Nigg, 2017) and these problems may have cascading consequences across the rest of development (Masten & Cicchetti, 2010). As a result, elucidating the nature and effects of early self-control development is a critical avenue of research.

Therefore, the current longitudinal study aimed to inform how self-control develops over time, as well as how changes in self-control are influenced by earlier home environments and associated in turn with later risk-taking outcomes. Specifically, the current study sought to determine if subgroups of individuals had different developmental trajectories of self-control from middle childhood through early adolescence. The present study also sought to determine if structural home environments, including socioeconomic status (SES) and household chaos, were associated with these developmental trajectories of self-control above and beyond the more relationally oriented home environment, namely parent-child relationship quality. Finally, the present study examined how self-control trajectories from middle childhood through early adolescence were in turn associated with risk-taking behavior in middle-adolescence.

Presently, the terms self-control and self-regulation are used interchangeably and broadly define the construct as the volitional act of managing attention and arousal in a manner that facilitates goal-directed behavior (Blair & Ursache, 2011). Self-control and self-regulation are also used presently as umbrella terms to encompass the many nuanced dimensions of the construct which subserve goal-directed behavior. For example, terms such as executive function, cognitive control, inhibition, and emotion regulation are all interwoven within the conceptualization of self-control/self-regulation by various researchers. Fortunately, an important recent review has been devoted to untangling these dimensions, terms, and meanings across fields and literatures by defining their roles within self-control/self-regulation for better clarity among researchers (Nigg, 2017). According to Nigg (2017), self-regulation and self-control are domain general, with self-control reflecting the top-down aspects of self-regulation. As such, the current study reviews literature including many of

these individual dimensions of self-control/self-regulation as support for the broader self-control/self-regulation framework.

Extant literature has proposed that self-control develops largely throughout childhood (Vazsonyi & Huang, 2010), but also continues to evolve during adolescence (Steinberg, 2008). Empirical research suggests that across adolescence, individuals demonstrate linear growth in the prefrontal cortex (Ordaz et al., 2013), and this maturation is reflected in longitudinal increases in performance on executive functioning tasks from early to late adolescence (Boelema et al., 2014) as well as self-control (effortful control and impulsivity) across pre- to middle-adolescence (King, Lengua, & Monahan, 2013). In particular, despite the findings of significant variation in the rate of self-control development over time (e.g., King et al., 2013), it is not known whether there are distinctive patterns of developmental trajectories that meaningfully capture individual differences in the development of self-control. Prediction of these different patterns of self-control development may be a critical step toward disrupting trajectories that deviate from normative linear growth over time.

As noted by recent behavioral genetic research, biology plays a critical role in self-control development; however, environmental and social factors are also critical in elucidating the full nature of the evolution of self-control (Vazsonyi, Roberts, & Huang, 2015). For example, parenting behaviors and other socially oriented environmental factors play critical roles in the development of self-control of emotions and thoughts (e.g., Berry, McCartney, Petrill, Deater-Deckard, & Blair, 2013). Less is known, however, regarding the role that structural home environments, such as SES and household chaos, play in the development of self-control, above and beyond the effects of caregiving behaviors.

SES, Household Chaos, and Self-Control

Low SES has been identified as a prominent risk factor for a host of negative outcomes, including the inhibited development of self-control (Wickrama, O'Neal, & Holmes, 2017). A multitude of empirical studies have corroborated this hypothesis by demonstrating a consistent association between SES and self-control (e.g., Brody, Flor, & Morgan Gibson, 1999; Hughes, Ensor, Wilson, & Graham, 2009). These differences may arise due to disadvantages in terms of access to quality education, healthcare, nutrition, and other resources which may aid in psychological and neurobiological development. In parallel, research has indicated that household chaos, defined as confusion, clutter, and ambient noise in the home, is a risk factor predicting individual differences in self-control (Vernon-Feagans, Willoughby, & Garrett-Peters, 2016). Although household chaos and SES have been found to be related, such that households with low SES are more likely to be characterized as chaotic (i.e., with less structure, routine, and predictability; Evans, Gonnella, Marcynyszyn, Gentile, & Salpekar, 2005), previous literature has distinguished them as separate constructs. For example, prior studies have demonstrated that household chaos is associated with individual differences in adjustment after controlling for SES, and changes in household chaos are associated with changes in cognitive and social adjustment when SES is not altered (e.g., Evans, 2006; Evans, Eckenrode, & Marcynyszyn, 2010; Wachs & Evans, 2010).

As such, household chaos may have independent, yet similarly pernicious effects as low SES on development. The detrimental effects of household chaos on self-control have been shown in early childhood with research indicating that higher household chaos at age three was associated with lower inhibitory control at age four (Hardaway, Wilson, Shaw, & Dishion, 2012). Similarly, other work has demonstrated that adolescents who spent a larger part of their early life in a more chaotic environment showed lower task persistence than adolescents in less chaotic homes (Fuller-Rowell, Evans, Paul, & Curtis, 2015). A recent longitudinal study has also revealed both poverty and household chaos (i.e., disorganization) measured in early childhood were significantly associated with poor self-regulation in kindergarten (Vernon-Feagans et al., 2016). Such maleficent effects of household chaos on self-control development are likely a result of the disruption of proximal processes critical for self-control development (Bronfenbrenner, 2001; Hardaway et al., 2012). Specifically, household chaos may be associated with overstimulation and overarousal and may make the regulation of thoughts, emotions, and behaviors arduous in a family with erratic routines and shifting expectations (Evans et al., 2010; Hardaway et al., 2012). Moreover, it has been posited that limit setting and scaffolding may be lower in such environments, which are necessary for the development of self-control (Lengua, Honorado, & Bush, 2007). Consequently, it is difficult for children to understand the connection between action and outcomes and internalize the regulation of actions in such an environment characterized by irregularity (Hardaway et al., 2012).

Taken together, existing literature robustly supports the links between structural home environmental risk factors, including lower SES and higher household chaos, and self-control. Furthermore, these particular environmental factors tend to elicit instability and unpredictability in the child's environment. Prior research indicates that unpredictable environments associated with low SES may promote present-orientation and impulsivity (Frankenhuis, Panchanathan, & Nettle, 2016). It is plausible that low SES and household chaos might tax attentional resources and cognitive control (e.g., Mullainathan & Shafir, 2013), and such cognitive strain undermines the development of self-control. However, there has been no systematic investigation regarding independent and relative contributions of SES and household chaos (independent of parenting) to different developmental trajectories of self-control across middle-to-late childhood, and if the developmental consequences of those trajectories are related to risk taking in middle adolescence. These contextual factors are critical to explore, as they allow the identification not only of youth at-risk for impaired development of self-control, but also factors that can be targeted for preventive intervention efforts.

Self-Control and Risk Taking

Risk taking during adolescence poses a severe challenge to lifelong health and wellbeing. Extant work has highlighted the spike in risk-taking behaviors that occurs during the adolescent period, including increased crime, delinquency, truancy, substance use, risky sexual behaviors, and antisocial behaviors (e.g., Steinberg, 2007). This spike in risk taking has been explained through developing neurobiological systems, including the cognitive control system (a critical aspect of self-control) which is associated with prefrontal regions of the brain that mature gradually throughout adolescence (Casey, Getz, & Galvan, 2008;

Steinberg, 2008). Although there has been limited literature examining self-control development across both childhood and adolescence, it is expected that higher self-control in childhood and pre-adolescence may help deter this neurobiological susceptibility to risk taking in adolescence. Indeed, a wide array of adolescent research has emphasized the important role of self-control for youth risk-taking behaviors, including substance use and risky sexual behaviors (e.g., Kahn, Holmes, Farley, & Kim-Spoon, 2015; Magar, Phillips, & Hosie, 2008; Romer et al., 2011).

Similarly, higher self-regulation has been longitudinally associated with lower risk-taking behaviors, such as substance use, association with deviant peers, and antisocial behavior among middle school students (Fosco, Frank, Stormshak, & Dishion, 2013). Growth curve analyses have also revealed that increases in self-control were associated with decreases in deviant behaviors throughout childhood (Vazsonyi & Huang, 2010). Moreover, there is evidence suggesting that lower self-regulation mediates the link between higher household chaos and higher externalizing problems among young children (Hardaway et al., 2012) and the link between higher family financial stress and sexual risk taking among adolescents (Crandall, Magnusson, & Novilla, 2017). Taken together, prior literature has established the prominent role the home environment plays in the development of youth self-control and, in turn, the prominent role self-control plays in deterring risk-taking behaviors.

The Present Study

Given the theoretical and empirical evidence implicating the influential roles of the home environment in self-control development and the primacy of self-control for risk taking, the current longitudinal study sought to address the nature of individual differences in self-control development by identifying latent classes of self-control trajectories through growth mixture modeling. The present study further examined how structural home environments, including SES and household chaos, predict different patterns of self-control trajectories, and how different self-control trajectories in childhood are subsequently related to risk taking in adolescence. It was hypothesized that lower SES and higher household chaos in middle childhood (age 8.5) would be associated with maladaptive trajectories of self-control in middle childhood to late childhood (ages 8.5 – 11.5) even after controlling for the contribution of parent-child relationship quality and possible sex differences (Hypothesis 1), and maladaptive self-control trajectories from middle childhood through late childhood (ages 8.5 – 11.5) would be, in turn, associated with higher risk taking in adolescence (age 15; Hypothesis 2). Therefore, the current study moves above and beyond what prior research has demonstrated—i.e., associations between levels of home environments and adolescent adjustment—by identifying different subgroups with differential patterns of self-control development and investigating whether earlier home environment factors may predict differential patterns of self-control development, as well as which self-control subgroups are vulnerable to exhibiting problematic risk-taking behaviors in adolescence.

Method

Participants

Participants consisted of 1,083 individuals (50% males, 50% females) from the Study of Early Child Care and Youth Development (SECCYD) who participated in at least one data point at ages 8.5, 9.5, 10.5, or 11.5 (corresponding to grades 3, 4, 5, and 6 respectively). Complete details regarding SECCYD study design, including all measures used in the current study, can be accessed online (<https://www.icpsr.umich.edu/icpsrweb/ICPSR/series/00233>). Though the original SECCYD sample included 1,364 participants, 281 participants did not have self-regulation data at any of the four time points included in the present analyses and thus did not have an estimated self-control trajectory. Logistic regression analyses were conducted to determine if the participants who dropped out of the study before the initial time point for the analyses (age 8.5) were significantly different from included participants based on demographic data provided in Phase I (0 – 36 months of age). Mothers' ethnicity and income-to-needs ratio were not associated with inclusion in the study ($p > .05$). Participants were more likely to drop depending on study site ($p = .001$), if the child was female ($p = .02$), or if mothers had lower levels of education ($p < .001$). Of the 1,083 individuals with self-control trajectory estimates, 1,024 had available data for household chaos at age 8.5, 975 for SES at age 8.5, and 947 for risk taking at age 15. Given that not all participants participated at every time point, the full information maximum likelihood method was used to handle missing data.

At age 8.5, parent report of race revealed that approximately 82% of the children were White, 12% were Black, and 6% were other races. To characterize how family income relates to need, the income-to-needs (ITN) ratio was used, which is the level of household income divided by the poverty threshold for a family of that size. The average ITN ratio was 4.41 ($SD = 3.78$) at age 8.5 with 24% of the sample indicating poor to near poor (i.e., ITN ratio < 2 ; Ursache & Noble, 2016) (see Measures for detailed information). Participants were recruited at 10 different sites across the United States and study site was included in the final model as a covariate. When available, both mothers' and fathers' reports were used as an average in order to utilize a multi-informant method reducing the bias potentially arising from using a single reporter. The mother and father reports were largely consistent (see below for correlations) and the pattern of results did not meaningfully change when considering only mother reports or only father reports versus the composite of the two. If data for only a single parent were available, then only the single parent's rating was used in generating the variable. Procedures were approved by the institutional review board for each of the 10 study sites and written informed consent was received from each family.

Measures

Socioeconomic status.—SES was determined by mother report of income and family size at age 8.5. An income-to-needs (ITN) ratio was calculated by dividing the level of household income by the poverty threshold for family size. Therefore, a higher ITN ratio indicated higher SES.

Household chaos.—Household chaos was determined at age 8.5 via the average of mother and father report ($r = .53, p < .01$) on the Confusion, Hubbub, and Order (CHAOS) Scale (Matheny, Wachs, Ludwig, & Phillips, 1995). This scale measured environmental confusion, such as high levels of noise, crowding, and home traffic. The scale contained 15 items scored as “1 = true,” or “2 = false.” Typical items include, “We almost always seem to be rushed,” “It’s a real zoo in our home,” and “You can’t hear yourself think in our home.” Items were coded so that higher scores indicated greater chaos in the household. For the current study, Cronbach’s alpha was .79 for mothers and .76 for fathers.

Parent-child relationship quality.—Parent-child relationship quality was measured at age 8.5 via the average of mother and father report ($r = .41, p < .01$) on the Child-Parent Relationship Scale: Short Form which was adapted from the Student-Teacher Relationship Scale (Pianta, 1992). This scale measured parents’ feelings or beliefs about the study child’s attachment to the respective parent focusing on both conflict and closeness with the child. The scale contained 15 items with answers ranging from “1 = definitely does not apply” to “5 = definitely applies.” Typical items include, “My child values his/her relationship with me,” and “My child easily becomes angry with me.” Items were coded so that a higher score indicated a more positive parent-child relationship. Cronbach’s alpha was .81 for both mothers and fathers.

Self-control.—Self-control was measured using the average of mother and father report ($r = .45$ at age 8.5, $r = .54$ at age 9.5, $r = .52$ at age 10.5, and $r = .57$ at age 11.5; $p < .01$ for all) for the self-control subscale of the Social Skills Rating System (Gresham & Elliott, 1990) at ages 8.5 through 11.5. The subscale contained 10 items scored as “0 = never,” “1 = sometimes,” or “2 = very often.” Typical items include, “Ends disagreements with you calmly,” “Speaks in an appropriate tone of voice at home,” and “Controls temper when arguing with other children.” Items were coded so that higher scores indicated higher self-control. Over the four time points, Cronbach’s alpha ranged from .81 to .83 for mother reports and .81 to .86 for father reports.

Risk Taking.—Risk taking was measured at age 15 by adolescents’ self-report on a 19 item adaption of the Risky Behavior Questionnaire (Conger & Elder, 1994) which has been used previously (Kim-Spoon, Holmes, & Deater-Deckard, 2015). This scale included items reflecting a wide range of risk severity, such as “Ridden in a car without a seatbelt,” “Done something dangerous on a dare,” and “Smoked cigarettes or used tobacco.” Items were regarding the past year and were scored as “0 = never,” “1 = once or twice,” or “2 = more than twice.” All items were coded so that higher scores indicated greater risk taking. The full measure is available in the Appendix. For the current study, Cronbach’s alpha was .81.

Plan of Analysis

For all study variables, descriptive statistics were examined to determine normality of distributions. Acceptable levels of skewness and kurtosis were < 3 and < 10 , respectively (Kline, 2011), and all study variables fell below these thresholds. Little’s MCAR test indicated that the self-control data were missing completely at random ($\chi^2 = 29.44, df = 27, p = .34$), so Full Information Maximum Likelihood (FIML) was used to account for missing

data. Growth mixture modeling (GMM) was used to identify the smallest number of trajectory classes that described the repeatedly measured self-control variable well using *MPlus* statistical software version 7.4 (Muthén & Muthén, 2012). GMM estimates latent factors for intercepts and slopes of developmental trajectories on a univariate outcome, and tests whether there are two or more distinct classes of individuals in order to capture the heterogeneity in growth trajectories and determines the optimal class membership for each individual (Kim-Spoon & Grimm, 2016). As a result, each class made up of individuals with similar growth trajectories has uniquely estimated values for intercept and slope. Three criteria were used to determine the optimal number of classes as suggested by Tofghi and Enders (2007). First, sample-size adjusted Bayesian information criterion (SABIC; Sclove, 1987) indicated parsimony goodness of fit based on the log-likelihood adjusted for the number of parameters. Lower SABIC estimates are indicative of better model fit. Second, the adjusted Lo-Mendell-Rubin Test (ALMR; Lo, Mendell, & Rubin, 2001) is a nested model likelihood ratios test indicative of whether k trajectory classes provides a better fit than $k - 1$ trajectory classes. A small probability ($p < .05$), indicated that a $k - 1$ model should be rejected in favor of a model with at least k classes. Finally, usefulness of the classes was examined based on the number of individuals in each class (i.e., minimum of 5% or more in each class).

After determining the optimal number of self-control classes and the most likely membership of each individual by self-control trajectory class, multinomial logistic regression was used in SPSS to determine if self-control trajectory classes may be predicted by SES and household chaos measured at age 8.5, above and beyond parent-child relationship quality, child sex, and study site. Finally, distinctiveness of the trajectory classes was validated by testing whether risk taking at age 15 was predicted by self-control trajectory class membership. That is, analysis of variance was used to determine differences in risk taking at age 15 across the different classes of self-control trajectories. If significant group differences were found, pairwise multiple comparisons using the Tukey post-hoc test were performed to determine which specific classes differed on the risk-taking outcome.

Results

Descriptive statistics and bivariate correlations for all study variables are presented in Table 1. First, latent class models (without predictors or covariates) were tested assuming a linear pattern of growth in self-control across the 4 time points (loadings of the latent slope factor were fixed to 0, 1, 2, and 3). Residual variances were left invariant across the latent classes. The models were estimated with 400 random starts and final optimization of 20. Using SABIC and ALMR, indices for one, two, three, four, and five class models were obtained (see Table 2). In identifying the model which best delineates the data, the k class model was chosen over the $k - 1$ model in which both the SABIC estimate decreased and the ALMR indicated a better fit for the k class model than the $k - 1$ class model. As a result, the four class model was identified as the model which best delineated the data into latent classes. This model resulted in negative variance of the slope factor; thus the variances of the latent factors were fixed to zero across all classes. Mean values of the intercept and slope were estimated for each of the four classes (see Table 3). As seen in Figure 1, the four classes

were characterized as Class 1: high and increasing, Class 2: mid-high and increasing, Class 3: mid-low and unchanging, and Class 4: low and unchanging.

The self-control means for each group by class were 17.47 at age 8.5, 18.04 at age 9.5, 17.74 at age 10.5, and 18.06 at age 11.5 for Class 1. For Class 2, the self-control means were 14.86 at age 8.5, 15.09 at age 9.5, 15.17 at age 10.5, and 15.18 at age 11.5. For Class 3, the self-control means were 12.23 at age 8.5, 12.33 at age 9.5, 12.25 at age 10.5, and 12.29 at age 11.5. For Class 4, the self-control means were 9.59 at age 8.5, 9.51 at age 9.5, 9.33 at age 10.5, and 9.16 at age 11.5.

The model was also tested under a quadratic pattern of growth (latent quadratic factor loadings fixed to 0, 1, 4, and 9) to compare against the linear growth model. The SABIC for the one-class quadratic GMM was higher (1700.49) than the SABIC for the linear growth model (1354.49). Thus, model fit comparison indicated that the linear growth model was a more parsimonious model than the quadratic growth model, and the class memberships and estimates from the linear growth model were examined.

Next, the most likely class membership was extracted for each participant and performed multinomial logistic regression analyses in SPSS to predict membership of the four classes of self-control growth from SES and household chaos at age 8.5, while controlling for the effects of the covariates (parent-child relationship quality, child sex, and study site). Because the primary interest was in understanding antecedents associated with the most vulnerable subgroup, Class 4 (low and unchanging; the highest risk group) was used as the reference group. As seen in Table 3, the multinomial logistic regression analyses (McFadden Psuedo $R^2 = .19$) indicated that higher SES and lower household chaos predicted membership in self-control growth trajectory classes which had higher initial levels of self-control and, in most cases, higher growth rates of self-control. Specifically, higher SES and lower household chaos significantly differentiated Class 2 membership (mid-high and increasing) and Class 1 membership (high and increasing) in reference to Class 4 (low and unchanging). Higher SES significantly differentiated Class 3 membership (mid-low and unchanging) in reference to Class 4 (low and unchanging).

Finally, one-way ANOVA using SPSS was performed to examine the associations between class trajectories of self-control and risk taking at age 15. Results indicated risk taking differed significantly among the identified classes ($F = 5.36, p < .01$, Eta Squared = .02). Therefore, Tukey post-hoc analyses were employed to probe differences in risk taking among the self-control classes. As seen in Table 4, Class 1 (high and increasing) was significantly lower than Class 4 (low and unchanging) in risk taking. Class 2 (mid-high and increasing) was also significantly lower in risk taking compared to Class 3 (mid-low and unchanging) and to Class 4 (low and unchanging). However, Class 1 (high and increasing) did not differ significantly in risk taking from Class 2 (mid-high and increasing) or Class 3 (mid-low and unchanging), and there were no significant differences in risk taking between the two lower self-control trajectories: Class 3 (mid-low and unchanging) and Class 4 (low and unchanging).

As supplemental analyses, regression analyses were conducted with self-control class dummy variables to examine the effects of both the home environment factors and the self-control classes on the risk-taking outcome. SES ($b = -0.01$, $SE = 0.002$, $p = .002$) and household chaos ($b = 0.09$, $SE = 0.04$, $p = .04$) were significantly associated with risk taking, whereas parent-child relationship ($b = -0.04$, $SE = 0.02$, $p = .08$) and self-control class variables (dummy-coded with Class 4 as the reference variable) were not significantly associated with risk taking (Class 1: $b = -0.01$, $SE = 0.03$, $p = .70$, Class 2: $b = -0.03$, $SE = 0.03$, $p = .25$, Class 3: $b = 0.003$, $SE = 0.03$, $p = .90$). This finding suggests the powerful, long-term effects of the home environment factors on risk-taking behaviors.

Discussion

Self-control is critical for a variety of risk-taking behaviors such as deviance, crime, and health-risk behaviors (Gottfredson & Hirschi, 1990; Nigg, 2017). Identifying risk and protective factors that may enhance or disrupt self-control development, therefore, is an area of research with high importance. Additionally, childhood and adolescence are critical periods for self-control development, and this development has cascading effects across the rest of the lifespan. Therefore, the present study sought to explore the development of self-control across childhood, home-level antecedents of self-control development, and the link between self-control development and risk taking in adolescence.

Four distinctive latent classes of self-control trajectories were identified. The classes were characterized as high and increasing, mid-high and increasing, mid-low and unchanging, and low and unchanging. Notably, the two classes with the highest initial levels of self-control at age 8.5 (Classes 1 and 2) were also the only classes in which self-control significantly increased over the four time points. The increasing self-control observed in these classes is consistent with prior work demonstrating that normative patterns of self-control show increases over time (King et al., 2013; Ordaz et al., 2013). In contrast, the classes with lower initial levels of self-control (Classes 3 and 4) demonstrated no growth in self-control over time and Class 4 even had a negative slope (albeit with a marginal significance level). Taken together, the data indicated that individuals with higher levels of self-control in middle childhood show an increase in self-control into late childhood, whereas individuals with lower levels of self-control in middle childhood do not show positive growth in self-control skills, thereby widening the gap in self-control which was already evidenced at baseline. These trajectories emphasize that interventions for development of self-control may need to occur earlier than middle childhood in order to be most effective in positively altering self-control growth trajectories through the rest of childhood and into adolescence. However, it should be noted that children not demonstrating self-control growth may still be able to do so after age 8.5 with the proper interventions targeted to improve it. The findings also indicate the importance of distinguishing between the individuals landing in the “middle-of-the-road” in terms of self-control in middle childhood (i.e., Class 2, mid-high and increasing, and Class 3, mid-low and unchanging) in order to identify individuals who have more potential to increase in self-control further over middle-to-late childhood versus those who may have already reached a self-control ceiling.

Next, it was tested whether higher household chaos and lower SES in middle childhood (age 8.5) were associated with maladaptive trajectories of self-control in middle childhood to late childhood (ages 8.5 – 11.5) after controlling for the effects of parent-child relationship quality, child sex, and study site. The findings indicated that experiencing low SES in middle childhood is likely to place the child at risk for showing the lowest levels and unchanging growth in self-control throughout middle-to-late childhood. That is, SES differentiated children with the lowest, unchanging self-control from other children with higher self-control and/or increasing trends. Experiencing higher household chaos in middle childhood differentiated children with the lowest, unchanging levels from those with positive growth in self-control, but not necessarily from those with higher levels and no growth in self-control.

Such findings corroborate previous studies in which higher household chaos and lower SES were longitudinally associated with lower task persistence, an indicator of self-control among adolescents (Fuller-Rowell et al., 2015). However, the present study extends these findings by demonstrating how higher household chaos and lower SES may identify those who are most vulnerable to exhibit no growth in self-control over time, rather than simple associations with self-control for the whole sample. The current findings also corroborate and extend the work of Vazsonyi and Huang (2010) who examined antecedents and consequences of self-control growth within childhood using growth curve modeling. Specifically, Vazsonyi and Huang (2010) viewed the sample as one homogeneous group and found a sample-wide self-control trajectory of small yet significant growth. In contrast, the present study used growth mixture modeling through which distinctive patterns of individual differences are revealed. The analyses demonstrated distinctive subgroups of children with differential trajectories that can be described by initial levels as well as patterns of growth. As such, the current study presents evidence that considerations of individual differences in self-control development are critical for a more nuanced understanding of this developmental process as well as for identifying subgroups of individuals that show impaired development. In particular, findings from the current study provide an important first step by providing preliminary evidence for preventive intervention strategies for children exposed to high household chaos and low SES who may be identified as particularly at-risk for maladaptive self-control trajectories. Interventions targeting self-control over middle-to-late childhood, or earlier, may be particularly effective for children in such vulnerable home environments. Furthermore, the current study illustrates the consequence of poor self-control development during childhood: The increases in risk-taking behaviors in adolescence evinced by the maladaptive self-control trajectory subgroups indicate the importance of positive self-control development through middle-to-late childhood in later adjustment.

Along such lines, given the association between lower SES and higher chaos with poor self-control development, the current findings indicate that intervention strategies targeting children exposed to home environments characterized by lower SES and higher chaos may be crucial to help alter the poor self-control trajectories to which they may be more vulnerable. Previous findings, along with the present study, therefore indicate the importance of elucidating the association between structural home environments, including SES and household chaos, and positive self-control development in youth, above and beyond parent-child relationship quality. Specifically, not only is early intervention important (i.e., before

middle childhood), but targeting youth in at-risk home environments (e.g., lack of routine and structure) with interventions geared towards promoting self-control is crucial for deterring maladaptive self-control trajectories that cascade into severe lifelong consequences. For example, the finding that high levels of household chaos can negatively affect self-control development provides a specific target for intervention efforts. Given that positive proximal processes can be disrupted in chaotic contexts (Bronfenbrenner, 2001), reducing existing chaos in the home environment would facilitate the success of proximal interventions. Household chaos, though correlated with other aspects of socioeconomic risk, can be modified through effective intervention with families and through government policies that reduce uncertainty and distractions in children and adolescents' environments (Evans & Wachs, 2010).

Finally, the hypothesis that higher self-control trajectories from middle childhood through late childhood would be associated with lower risk taking in adolescence was also supported. The present study provides support for previous studies indicating the importance of self-control for health risk behaviors (e.g., Magar et al., 2008). The pattern of results is also congruent with research demonstrating growth trajectories of self-control are associated with decreases of deviance during childhood (Vazsonyi & Huang, 2010). However, the present findings extend this previous work in several important ways (1) to include more general adolescent risk-taking behaviors, (2) to demonstrate prospective associations of self-control trajectories during middle-to-late childhood with risk taking in mid adolescence and, (3) to do so with identifying distinctive subgroups that exhibit differential trajectories and associations with the risk-taking outcome. Given that, to date, no available study has utilized a "high-risk" sample (i.e., low SES, high chaos, and high risk taking, or a combination therein) to study longitudinal trajectories of self-control, the current study provides great value regarding self-control development and effects of SES and chaos, as well as the consequence of risk-taking behaviors using a community sample. Additionally, considering that the current study investigated the normative variability of SES and household chaos, it is expected that these effects would only be stronger in higher-risk samples.

Findings of the current study need to be considered in view of some limitations. First, the current study relies on a single method (parent- or self-report) which may introduce some degree of method bias. Future studies may benefit from exploring the current hypothesis with multiple methods (e.g., behavioral tasks or observer ratings). It is also noted that the informants for measures switched from parent report in ages 8.5–11.5 to self-report at age 15. This was due to the limited measures available in the dataset at each time point, in this secondary data analysis. However, parent reports of home environment variables as well as multi-informant (based on both mothers and fathers) reports of self-control would be more reliable than child self-reports of these constructs, given the threat to validity of self-report in childhood as a result of a child's limited verbal and cognitive comprehension skills (Fabes, Martin, & Hanish, 2009; Holmes, Kim-Spoon, & Deater-Deckard, 2016). At age 15, however, the adolescent may be better suited to report risk-taking behaviors than his or her parents, considering that adolescents may have better knowledge of themselves than other reporters (e.g., Ladd, 2005), and may conceal risk-taking behaviors from their parents. Second, the generalizability of the results are limited by the relative homogeneity of the current sample (albeit a large, nationwide sample) with regards to ethnicity and the relatively

low levels of the proportion of the sample living in poverty and the prevalence of adolescent risk-taking behaviors, and the relatively high quality of parent-child relationships. Relatedly, the scale used to measure risk-taking behaviors had answer categories covering a broad range in frequency (i.e., the highest level was “two or more”), and thus may have not been able to sensitively indicate extremely high levels of prevalence and severity. While these factors may be limitations to the study’s generalizability, the effects of home environments found in the current study could have been stronger, not weaker, if there were more high-risk families (e.g. extremely low levels of SES). Replication of the findings using samples with greater variety in racial/ethnic backgrounds, income levels, and deviant behaviors is warranted.

Third, there is a caveat that the current study utilized a data driven approach to the determination of the number of self-control trajectory classes, which could have been affected by idiosyncrasies of the data. For example, GMM approaches use descriptive labels for the groups within the *sample*, and the low self-control group may not reflect clinically troubled children within the *population*. Therefore, replication with theoretical expectations, potentially based on the current findings, would strengthen the inferences drawn from the results. Finally, the present study primarily focused on examining how structural home environments (i.e., SES and household chaos) contribute to self-control development. It is acknowledged that there are other important environmental-social relationship factors (e.g., family composition, family violence, and parenting practice) that contribute to the development of self-control in childhood and risk taking in adolescence.

Conclusions

The present investigation provides evidence for the importance of the home environment in the development of self-control. Specifically, lower SES and higher household chaos are risk factors for lower self-control in middle childhood as well as suppressed self-control growth from middle childhood through late childhood. The importance of these findings is underscored by the association between maladaptive self-control trajectories with higher risk taking in adolescence. In line with the developmental cascades theory (Masten & Cicchetti, 2010), low SES and high household chaos may be seen as having negative cascading effects, as poor self-control may have a wide array of negative, snowballing consequences. For instance, research has shown that adolescents with lower levels of self-control were more likely to be caught in “snares” that resulted in a greater likelihood they would be trapped in a harmful lifestyle during adulthood (Moffitt et al., 2011). Findings from the present study may provide preliminary guidance for prevention and intervention efforts that target these potentially debilitating consequences. The findings suggest that to be most effective, prevention or intervention programs should aim towards identifying children at risk for low self-control before middle childhood. Additionally, researchers may be able to make even greater gains by identifying and targeting malleable risk factors such as household chaos that contribute to the development of self-control.

Acknowledgements

This work was supported by grants from the National Institute on Drug Abuse awarded to Jungmeen Kim-Spoon/ Brooks King-Casas (DA036017) and Gene Brody (DA 027827). We thank Kathy Faris for reviewing literature

relevant to the current study and Eileen Neubaum Carlan for editorial assistance. The Study of Early Child Care and Youth Development was conducted by the NICHD Early Child Care Research Network, and was supported by NICHD through a cooperative agreement that calls for scientific collaboration between the grantees and the NICHD staff. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institute of Child Health and Human Development or the National Institutes of Health. The authors thank the study participants and research staff.

Funding

This work was supported by grants from the National Institute on Drug Abuse awarded to Jungmeen Kim-Spoon/Brooks King-Casas (DA036017) and Gene Brody (DA 027827).

Appendix: 19 Item of the Risky Behavior Questionnaire (Conger & Elder, 1994)

-
1. Ridden in a car without a seatbelt
 2. Ridden on a bike without a helmet
 3. Done something dangerous on a dare
 4. Carried a weapon somewhere
 5. Threatened to beat up someone to make them do something
 6. Taken part in a gang fight
 7. Skipped school without permission
 8. Had a fist fight with another person
 9. Purposely set a fire in a building or in any other place
 10. Hurt an animal on purpose
 11. Smoked a cigarette or used tobacco
 12. Drunk a bottle or glass of beer or other alcohol
 13. Used or smoked marijuana, grass, pot, weed
 14. Taken or stolen something not yours worth a lot, like a video game
 15. Taken or stolen something not yours worth little, like candy
 16. Gotten into someplace like a movie or game without paying
 17. Run away from home
 18. Broken into a building to take or steal something
 19. Purposely damaged or destroyed property that wasn't yours
-

Biography

Christopher Holmes is a Postdoctoral Research Associate at the Center for Family Research at the University of Georgia. His research interests include risk and protective factors for developmental psychopathology and risk taking in adolescents.

Alexis Briant is a doctoral student at Virginia Polytechnic Institute and State University. Her research interests include risk and protective factors for developmental psychopathology and risk taking in adolescents.

Rachel Kahn is a Psychological Associate at the Sand Ridge Secure Treatment Center. Her interests include emotional and behavioral factors associated with externalizing psychopathology during adolescence and adulthood.

Kirby Deater-Deckard is a Professor of Psychology at the University of Massachusetts, Amherst. His research focuses on child/adolescent socialemotional and cognitive development, parenting and family environments, developmental psychopathology, and behavioral genetics and individual differences.

Jungmeen Kim-Spoon is a Professor of Psychology at the Virginia Polytechnic Institute and State University. Her research interests include risk and protective factors in the development of psychopathology during adolescence.

References

- Berry D, McCartney K, Petrill S, Deater-Deckard K, & Blair C (2014). Gene–environment interaction between DRD4 7-repeat VNTR and early child-care experiences predicts self-regulation abilities in prekindergarten. *Developmental Psychobiology*, 56, 373–391. DOI: 10.1002/dev.21105 [PubMed: 23460366]
- Blair C, & Ursache A (2011). A bidirectional model of executive functions and self-regulation. In Vohs KD & Baumeister RF (Eds.), *Handbook of self-regulation: Research, theory, and applications* (2nd ed.). New York: Guilford.
- Boelema SR, Harakeh Z, Ormel J, & Hartman CA (2014). Executive functioning shows differential maturation from early to late adolescence: Longitudinal findings from a TRAILS study, *Neuropsychology*, 28, 177–187. 10.1037/neu0000049 [PubMed: 24364395]
- Brody GH, Flor DL, & Morgan Gibson N (1999). Linking maternal efficacy beliefs, developmental goals, parenting practices, and child competence in rural single-parent African American families. *Child Development*, 70, 1197–1208. DOI: 10.1111/1467-8624.00087 [PubMed: 10546340]
- Bronfenbrenner U (2001). Growing chaos in the lives of children, youth, and families: How can we turn it around? In Westman JC (Ed.), *Parenthood in America* (pp. 197–210). Madison, WI: University of Wisconsin Press.
- Casey BJ, Getz S, & Galvan A (2008). The adolescent brain. *Developmental Review*, 28, 62–77. DOI: 10.1016/j.dr.2007.08.003 [PubMed: 18688292]
- Conger RD, & Elder GH Jr (1994). *Families in Troubled Times: Adapting to Change in Rural America*. Social Institutions and Social Change Aldine de Gruyter: NY.
- Crandall AA, Magnusson BM, & Novilla MLB (2017). Growth in adolescent self-regulation and impact on sexual risk-taking: A curve-of-factors analysis. *Journal of Youth and Adolescence*, 47, 1–14. doi:10.1007/s10964-017-0706-4 [PubMed: 29030792]
- Deater-Deckard K, Mullineaux PY, Beekman C, Petrill SA, Schatschneider C, & Thompson LA (2009). Conduct problems, IQ, and household chaos: A longitudinal multi-informant study. *Journal of Child Psychology and Psychiatry*, 50(10), 1301–1308. DOI: 10.1111/j.1469-7610.2009.02108.x [PubMed: 19527431]
- Evans GW (2006). Child development and the physical environment. *Annual Review of Psychology*, 57, 423–451. DOI: 10.1146/annurev.psych.57.102904.190057
- Evans GW, & Wachs TD (Eds.) (2010). *Chaos and its influence on children's development*. Washington, DC: American Psychological Association
- Evans GW, Eckenrode J, & Marcynyszyn LA (2010). Chaos and the macrosetting: The role of poverty and socioeconomic status. In Evans GW & Wachs TD (Eds.), *Chaos and its influence on children's development: An ecological perspective* (pp. 225–238). DOI: 10.1037/12057-014
- Evans GW, Gonnella C, Marcynyszyn LA, Gentile L, & Salpekar N (2005). The role of chaos in poverty and children's socioemotional adjustment. *Psychological Science*, 16, 560–565. DOI: 10.1111/j.0956-7976.2005.01575.x [PubMed: 16008790]
- Fabes RA, Martin CL, & Hanish LD (2009). Children's behaviors and interactions with peers. In Rubin KH, Bukowski WM, & Laursen B (Eds.), *Handbook of peer interactions, relationships, and groups* (pp. 45–62). New York, NY: Guilford.
- Fosco GM, Frank JL, Stormshak EA, & Dishion TJ (2013). Opening the “Black Box”: Family Check-Up intervention effects on self-regulation that prevents growth in problem behavior and substance

- use. *Journal of School Psychology*, 51, 455–468. DOI: 10.1016/j.jsp.2013.02.001 [PubMed: 23870441]
- Frankenhuis WE, Panchanathan K, & Nettle D (2016). Cognition in harsh and unpredictable environments. *Current Opinion in Psychology*, 7, 76–80. doi:10.1016/j.copsyc.2015.08.011
- Fuller-Rowell TE, Evans GW, Paul E, & Curtis DS (2015). The role of poverty and chaos in the development of task persistence among adolescents. *Journal of Research on Adolescence*, 25, 606–613. DOI: 10.1111/jora.12157
- Giancola PR, & Mezzich AC (2003). Executive functioning, temperament, and drug use involvement in adolescent females with a substance use disorder. *Journal of Child Psychology and Psychiatry*, 44, 857–866. DOI: 10.1111/1469-7610.00170 [PubMed: 12959494]
- Gottfredson MR, & Hirschi T (1990). *A General Theory of Crime* Stanford University Press.
- Gresham FM, & Elliott SN (1990). *Social Skills Rating System: Manual* American Guidance Service.
- Hardaway CR, Wilson MN, Shaw DS, & Dishion TJ (2012). Family functioning and externalizing behaviour among low-income children: Self-regulation as a mediator. *Infant and Child Development*, 21, 67–84. DOI: 10.1002/icd.765 [PubMed: 22879800]
- Hart SA, Petrill SA, Deckard KD, & Thompson LA (2007). SES and CHAOS as environmental mediators of cognitive ability: A longitudinal genetic analysis. *Intelligence*, 35, 233–242. DOI: 10.1016/j.intell.2006.08.004 [PubMed: 19319205]
- Holmes CJ, Kim-Spoon J, & Deater-Deckard K (2016). Linking executive function and peer problems from early childhood through middle adolescence. *Journal of Abnormal Child Psychology*, 44, 31–42. DOI: 10.1007/s10802-015-0044-5 [PubMed: 26096194]
- Hughes C, Ensor R, Wilson A, & Graham A (2009). Tracking executive function across the transition to school: A latent variable approach. *Developmental Neuropsychology*, 35, 20–36. DOI: 10.1080/87565640903325691
- Kahn RE, Holmes C, Farley JP, & Kim-Spoon J (2015). Delay discounting mediates parent–adolescent relationship quality and risky sexual behavior for low self-control adolescents. *Journal of Youth and Adolescence*, 44, 1674–1687. DOI: 10.1007/s10964-015-0332-y [PubMed: 26202153]
- Kim-Spoon J & Grimm KJ (2016). Latent growth modeling and developmental psychopathology. In Cicchetti D (Ed.), *Development and Psychopathology* (3rd ed): Volume I Theory and Method (pp. 986–1041). John Wiley & Sons.
- Kim-Spoon J, Holmes C, & Deater-Deckard K (2015). Attention regulates anger and fear to predict adolescent risk-taking behaviors. *Journal of Child Psychology and Psychiatry*, 56, 756–765. DOI: 10.1111/jcpp.12338 [PubMed: 25280179]
- King KM, Lengua LJ, & Monahan KC (2013). Individual differences in the development of self-regulation during pre-adolescence: Connections to context and adjustment. *Journal of Abnormal Child Psychology*, 41, 57–69. DOI: 10.1007/s10802-012-9665-0 [PubMed: 22865096]
- Kline RB (2011). *Principles and practice of structural equation modeling* (3rd ed.). New York, NY: Guilford Press.
- Ladd GW (2005). *Children's peer relations and social competence: A century of progress* Yale University Press.
- Lengua LJ, Honorado E, & Bush NR (2007). Contextual risk and parenting as predictors of effortful control and social competence in preschool children. *Journal of Applied Developmental Psychology*, 28, 40–55. DOI: 10.1016/j.appdev.2006.10.001 [PubMed: 21687825]
- Lo Y, Mendell NR, & Rubin DB (2001). Testing the number of components in a normal mixture. *Biometrika*, 88, 757–778. DOI: 10.1093/biomet/88.3.767
- Magar EC, Phillips LH, & Hosie JA (2008). Self-regulation and risk-taking. *Personality and Individual Differences*, 45, 153–159. DOI: 10.1016/j.paid.2008.03.014
- Masten AS, & Cicchetti D (2010). Developmental cascades. *Development and Psychopathology*, 22, 491–495. DOI: 10.1017/S0954579410000222 [PubMed: 20576173]
- Matheny AP, Wachs TD, Ludwig JL, & Phillips K (1995). Bringing order out of chaos: Psychometric characteristics of the confusion, hubbub, and order scale. *Journal of Applied Developmental Psychology*, 16, 429–444. DOI: 10.1016/0193-3973(95)90028-4

- Moffitt TE, Arseneault L, Belsky D, Dickson N, Hancox RJ, Harrington H, & Caspi, (2011). A gradient of childhood self-control predicts health, wealth, and public safety. *Proceedings of the National Academy of Sciences*, 108, 2693–2698. DOI: 10.1073/pnas.1010076108.
- Mullainathan S, & Shafir E (2013). *Scarcity: Why having too little means so much* New York, NY: Time Books.
- Muthén LK and Muthén BO (1998–2012). *Mplus User's Guide* (7th ed.). Los Angeles, CA: Muthén & Muthén.
- Nigg JT (2017). Annual Research Review: On the relations among self-regulation, self-control, executive functioning, effortful control, cognitive control, impulsivity, risk-taking, and inhibition for developmental psychopathology. *Journal of Child Psychology and Psychiatry*, 58, 361–383. DOI: 10.1111/jcpp.12675 [PubMed: 28035675]
- Ordaz SJ, Foran W, Velanova K, & Luna B (2013). Longitudinal growth curves of brain function underlying inhibitory control through adolescence. *Journal of Neuroscience*, 33, 18109–18124. DOI:10.1523/JNEUROSCI.1741-13.2013 [PubMed: 24227721]
- Pianta R (1992). *Student-Teacher Relationship Scale* Charlottesville, VA: University of Virginia.
- Romer D, Betancourt LM, Brodsky NL, Giannetta JM, Yang W, & Hurt H (2011). Does adolescent risk taking imply weak executive function? A prospective study of relations between working memory performance, impulsivity, and risk taking in early adolescence. *Developmental Science*, 14, 1119–1133. DOI: 10.1111/j.1467-7687.2011.01061.x [PubMed: 21884327]
- Sclove LS (1987). Application of model-selection criteria to some problems in multivariate analysis. *Psychometrika*, 53, 333–343. DOI: 10.1007/BF02294360
- Steinberg L (2007). Risk taking in adolescence new perspectives from brain and behavioral science. *Current Directions in Psychological Science*, 16, 55–59. DOI: 10.1111/j.1467-8721.2007.00475.x
- Steinberg L (2008). A social neuroscience perspective on adolescent risk-taking. *Developmental Review*, 28, 78–106. DOI: 10.1016/j.dr.2007.08.002 [PubMed: 18509515]
- Tofighi D, & Enders CK (2007). Identifying the correct number of classes in growth mixture models. In Hancock GR (Ed.), *Advances in latent variable mixture models* Charlotte, NC: Information Age.
- Ursache A, & Noble KG (2016). Neurocognitive development in socioeconomic context: Multiple mechanisms and implications for measuring socioeconomic status. *Psychophysiology*, 53, 71–82. doi:10.1111/psyp.12547 [PubMed: 26681619]
- Vazsonyi AT, & Huang L (2010). Where self-control comes from: on the development of self-control and its relationship to deviance over time. *Developmental Psychology*, 46, 245–257. DOI: 10.1037/a0016538 [PubMed: 20053021]
- Vazsonyi AT, Roberts JW, Huang L, & Vaughn MG (2015). Why focusing on nurture made and still makes sense: The biosocial development of self-control. In *The Routledge International Handbook of Biosocial Criminology* (pp. 263–279). Routledge New York.
- Vernon-Feagans L, Willoughby M, & Garrett-Peters P (2016). Predictors of behavioral regulation in kindergarten: Household chaos, parenting, and early executive functions. *Developmental Psychology*, 52, 430–441. DOI: 10.1037/dev0000087 [PubMed: 26751500]
- Wachs TD & Evans GW (2010). Chaos in context. In Evans GW & Wachs TD (Eds.). *Chaos and its influence on children's development: An ecological perspective* (pp. 3–13). Washington, DC: American Psychological Association DOI: 10.1037/12057-001
- Wickrama KAS, O'Neal CW, & Holmes C (2017). Towards a heuristic research model linking early socioeconomic adversity and youth cumulative disease risk: An integrative review. *Adolescent Research Review*, 2, 161–179. DOI:10.1007/s40894-017-0054-3

Figure 1.

Self-control trajectories from age 8.5 through age 11.5 by latent class membership.

Note: See text for mean values for each age by class.

Table 1
Descriptive Statistics and Bivariate Correlations of SES, Household Chaos, Self-Control, and Risk Taking

	Variables (age)	1	2	3	4	5	6	7	8	Mean (SD)	Range
1.	Household chaos (8.5)	-								1.32 (0.18)	1.07 – 1.93
2.	SES (8.5)	-.14*	-							4.41 (3.78)	0.09 – 26.64
3.	PC Relationship (8.5)	-.35*	.10*	-						4.18 (0.45)	2.33 – 5.00
4.	Self-control (8.5)	-.34*	.26*	.63*	-					13.69 (2.98)	4.00 – 20.00
5.	Self-control (9.5)	-.32*	.26*	.52*	.75*	-				13.91 (3.11)	4.50 – 20.00
6.	Self-control (10.5)	-.30*	.24*	.51*	.73*	.76*	-			13.82 (3.02)	4.00 – 20.00
7.	Self-control (11.5)	-.28*	.25*	.47*	.71*	.73*	.78*	-		13.84 (3.23)	2.00 – 20.00
8.	Risk taking (15)	.12*	-.14*	-.12*	-.13*	-.14*	-.13*	-.10*	-	0.27 (0.23)	0.00 – 2.00

Note: SES = socioeconomic status, PC Relationship = parent-child relationship quality

* $p < .01$.

Table 2.

Fit Indices for Latent Class Solutions

Number of latent classes	SABIC	ALMR	Entropy
1	20779.83	-	-
2	18895.16	1809.77 *	.85
3	18287.60		.82
4	18016.15	270.01 *	.81
5	17921.31	101.43	.80

Notes: Bold face indicates best fitting model, SABIC = sample-size adjusted Bayesian information criterion, ALMR = adjusted Lo-Mendell-Rubin Test.

* $p < .05$.

Table 3

Estimates of Intercept and Slope for Class Membership and Association of Age 8.5 Household Chaos and SES with Class Membership, Statistically Controlling for Parent-Child Relationship Quality, Child Sex, and Study Site

	Intercept mean	Slope mean	Members	Group Mean	b	SD	Wald (df = 1 for all)
Class 1 (highest, increasing)	17.53**	.14**	195				
Household chaos			(18.0%)	1.24	-3.34	.85	15.58**
SES				6.04	.41	.06	47.40**
PC Relationship				4.55	6.06	.46	176.66**
Child Sex				1.55	.52	.28	3.43
Study Site				-	.00	.05	.00
Class 2 (mid-high, increasing)	14.87**	.11*	354				
Household chaos			(32.7%)	1.29	-2.06	.64	10.27**
SES				4.78	.34	.06	34.35**
PC Relationship				4.28	3.19	.32	99.90**
Child Sex				1.54	.39	.24	2.73
Study Site				-	.01	.04	.11
Class 3 (mid-low, unchanging)	12.28**	.00	385				
Household chaos			(35.5%)	1.35	-.98	.57	3.00
SES				3.92	.25	.06	20.03**
PC Relationship				4.05	1.43	.27	28.87**
Child Sex				1.45	.06	.22	.07
Study Site				-	.02	.04	.16
Class 4^ (low, unchanging)	9.70**	-.13	149				
Household chaos			(13.8%)	1.42			
SES				2.63			
PC Relationship				3.75			
Child Sex				1.46			
Study Site				-			

Notes: SES = socioeconomic status, PC Relationship = parent-child relationship quality, child sex coded as 1 = male & 2 = female, ^ = multinomial regression reference group.

.10' < *d*
**
50' < *d*
*

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

Table 4.

Tukey Mean Level Differences and Standard Errors of Risk Taking at Age 15 by Latent Class of Self-Control Trajectory

Class	1(<i>j</i>)	2(<i>j</i>)	3(<i>j</i>)	4 (<i>j</i>)	Risk Taking
1(<i>i</i>) (highest, increasing)	-				.24
2(<i>i</i>) (mid-high, increasing)	.00 (.02)	-			.24
3(<i>i</i>) (mid-low, unchanging)	.05 (.02)	.05* (.02)	-		.30
4(<i>i</i>) (low, unchanging)	.07* (.03)	.07* (.02)	.02(.02)	-	.32

Note: Tukey mean difference (*SE*); Mean differences are calculated as (*i* – *j*).

*
p < .05.