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Parenting and Adolescent Self-Regulation Mediate between Family Socioeconomic Status and Adolescent Adjustment

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Abstract

Using two waves of longitudinal data, we utilized the family stress model of economic hardship (Conger & Conger, 2002) to test whether family socioeconomic status is related to adolescent adjustment (substance use and academic achievement) through parental knowledge and adolescent self-regulation (behavioral self-control and delay discounting). Participants included 220 adolescent (55% male, mean age = 13 years at Wave 1, mean age = 15 years at Wave 2) and primary caregiver dyads. Results of Structural Equation Modeling revealed significant three-path mediation effects such that low family socioeconomic status at Wave 1 is associated with low parental knowledge at Wave 1, which in turn was related to low academic performance and high substance use at Wave 2 mediated through low adolescent behavioral self-control at Wave 2. The results illustrate how parental knowledge, influenced by family economic status, may play an important role in the development of adolescent behavioral self-control and adjustment.

Keywords

socioeconomic status; parenting; self-control; delay discounting; adolescent adjustment

The effect of self-regulation on academic performance and substance use is well established in child/adolescent development literature (Dembo & Eaton, 2000; Wills, Walker, Mendoza, & Ainette, 2006). A family context variable of socioeconomic status (SES) is also associated with adolescent adjustment outcomes, including academic performance and substance use (Duncan et al., 1997; Walker, Greenwood, Hart, & Carta, 1994; Zwick & Green, 2007). The family stress model of economic hardship (Conger & Conger, 2002) describes a process through which low family SES can lead to increased levels of stress within a family. This model emphasizes that disrupted parenting behaviors, resulting from increased levels of distress, are related to negative adjustment outcomes among adolescents. In the current longitudinal study, we tested a mediational model proposing that lower family SES is associated with lower academic performance and greater substance use among adolescents because it is related to poor parenting behaviors, which in turn are associated with lower adolescent self-regulation. Although researchers have examined parts of the present model in children (McLoyd, 1998) and in college students (Patock-Peckman, Cheong, Balhorn, & Nagoshi, 2001), to authors' knowledge, the present study is the first to comprehensively

examine the joint contributions of family SES and self-regulation in tandem to changes in adjustment during adolescence.

Theories and definitions regarding self-regulation differ in psychological literature. Therefore, it is useful to define the characteristics attributed to self-regulation. We will define self-regulation as “exertion of control over the self by the self” (Muraven & Baumeister, 2000, pp. 247). Self-regulation then involves inhibiting or changing initial and dominant thoughts, feelings, or behaviors in order to maximize one’s own long-term rewards (Muraven & Baumeister, 2000). We selected these aspects of self-regulation based on recent literature suggesting that adolescent behaviors are guided, in part, by two separate but interacting neural systems: one an impulse system and the other a control system that can eventually exercise control over the impulse system (Bechara, 2005; Steinberg, 2010). Several researchers posit a similar dual-systems approach regarding self-regulation (e.g., Carver, 2005), and these dual systems are distinct and develop independently of one another (Cauffman et al., 2010; Shulman, Harden, Chein, & Steinberg, 2014). In our model, behavioral self-control (the ability to control or inhibit responses) represents the control system, whereas delay discounting (a measure of delay of gratification and impulsivity) represents the impulse system. Not only are these two systems distinct and independent, but extant literature indicates that self-report measures (i.e., behavioral self-control) and lab tasks (i.e., delay discounting) measuring impulsivity are also non-overlapping and measuring discrete domains of impulsivity (Cyders, & Coskunpinar, 2011; Cyders, & Coskunpinar, 2012). Whereas some researchers have suggested that adolescent risk-taking behaviors are evolutionarily adaptive because adolescents are encouraged to explore and experiment in their environment (e.g., Ellis et al., 2012), current theories regarding the neurobiology of the development of adolescent risk-taking behaviors, such as substance use, emphasize the significant role of the control system (Casey, Getz, & Galvan, 2008).

Family Socioeconomic Status Links to Adolescent Behavioral Self-Control, Delay Discounting, and Adjustment Outcomes

Behavioral self-control has been shown to positively contribute to academic performance (e.g., Duckworth & Seligman, 2005), whereas delay discounting (e.g., discounting of future rewards) has been shown to be positively related to substance abuse and addiction (e.g., Madden & Bickel, 2010). Recent research examining behavioral self-control suggests that those who grow up with low family SES are more likely to experience self-regulatory deficits than those with higher family SES because high levels of chronic stress produce long-term damage to regulatory systems, such as hindering neural development in the prefrontal cortex (Blair, 2010; Evans & Kim, 2013). This relationship has been primarily shown in children (e.g., Lengua, 2002; Lengua, Honorado, & Bush, 2007), and thus, it is important to examine this relationship in adolescents to determine differences throughout development. In order to further this extant literature, the current study examined the relationship between family SES and two critical aspects of adolescent self-regulation that are influential on both the positive and negative outcomes of adolescent academic performance and substance use: behavioral self-control and delay discounting. We believe that by examining both delay discounting and self-control, we will have a better

understanding of the role of self-regulation in explaining how low family SES is associated with important adolescent developmental outcomes such as academic performance and substance use.

Additionally, there is evidence of a direct association between family SES and adolescent academic outcomes. For example, adolescents from lower income families, compared to adolescents from higher income families, are more likely to have fewer total years of schooling, lower test scores, lower verbal ability, and they are less likely to complete high school (Brooks-Gunn & Duncan, 1997; Conger & Donnellan, 2007; Zwick & Green, 2007). Furthermore, adolescents who grow up in low-income families are more likely to demonstrate health risk behaviors such as smoking, drinking, and drug use (Brown, Catalano, Fleming, Haggerty, & Abbott, 2005; Wills, McNamara, & Vaccaro, 1995). Adolescents who grow up in poor families may be more likely to exhibit substance use because they are exposed to more stressors (e.g., crowding, community violence) than their higher SES counterparts (Belle, 1982; Evans & English, 2003) and may use substances to cope with their greater stress levels (Hussong, Jones, Stein, Baucom, & Boeding, 2011). However, it is important to examine the two co-occurring outcomes of adolescent academic performance and substance use in the same model to appreciate differential pathways involving self-regulation that lead to positive vs. negative adolescent outcomes.

Family Socioeconomic Status Links to Parental Knowledge

We propose that parenting behavior is a critical mediating process that links family SES and adolescent self-regulation as well as adjustment outcomes. According to the family stress model of economic hardship, parents' ability to monitor their adolescents is affected negatively by the stressors associated with living in a low-income environment. Parents in low-income families are consequently more likely to experience depression or demoralization and become less skillful at parenting which may be associated with negative effects on adolescent development (e.g., Conger et al., 1992; Solantaus, Leinonen, & Punamäki, 2004). In the present study, we examine parental knowledge of adolescents' activities as a form of parental monitoring. Parental knowledge is defined as how aware the parent is of what, where, and with whom the adolescent engages in different behaviors (Kim, Hetherington, & Reiss, 1999). Parents with a high family SES are more likely to make investments in their adolescents to promote skills that foster social competence, educational success, and healthy adjustment (Conger & Donnellan, 2007), which suggests that parents with a high level of human capital encourage similar human capital accumulation in their adolescents. Previous research has utilized the construct of parental knowledge to predict successfully externalizing behaviors and risky behaviors among adolescents (e.g., Crouter, Bumpus, Davis, & McHale, 2005; Kim et al., 1999).

Furthermore, parents with a low SES are likely to work more than one job to support their family (Brooks-Gunn & Duncan, 1997), leaving them with fewer opportunities to learn good monitoring skills and gain knowledge of their adolescents activities (Conger & Donnellan, 2007). Adolescents from economically disadvantaged families report that their parents know less about their activities than do adolescents from families living in better economic conditions (Shek, 2005). Although some researchers suggest that the relationship between

SES and parental monitoring may be relatively weak, they also state that research in this area is sparse (Hoff, Laursen, & Tardif, 2002); thus, it is important to fill a gap in existing literature, which fails to consider diverse aspects (e.g., income, social position) of SES and their relationship to parental knowledge.

Parental Knowledge Links to Adolescent Delay Discounting, Behavioral Self-Control, Academic Performance, and Substance Use

Prior studies suggest that levels of parental knowledge and monitoring are positively correlated with adolescent ability to self-regulate (Bowers et al., 2011; Crossley & Buckner, 2012) and correlated with higher levels of academic performance (Conger et al., 2002) and lower levels of substance use in adolescents (Wills & Yaeger, 2003). Parents with greater knowledge of their adolescents' behavior may help to guide and reinforce the development of adolescent self-regulation (Crossley & Buckner, 2012). Previous research has found that the relationship between parenting behaviors (e.g., acceptance, psychological control, and strict control) and adolescent behavior and emotional problems is partially mediated by adolescent behavioral self-control (Finkenauer, Engels, & Baumeister, 2005). The present study augments this finding by examining the pathways through which family context of SES influences positive and negative adolescent outcomes involving parental knowledge and adolescent self-regulation as mediating processes.

Adolescent Delay Discounting and Behavioral Self-Control Links to Academic and Substance Use Outcomes

Adolescents who have fewer self-regulatory skills show lower levels of academic performance (Evans & Rosenbaum, 2008; Tangney, Baumeister, & Boone, 2004), whereas adolescents with greater self-regulatory skills are more competent academic decision makers (Miller & Byrnes, 2001). The self-regulation and academic performance relationship may occur because adolescents with fewer self-regulatory skills are unable to delay the immediate reward of a fun activity for the delayed reward of a good academic performance. Extant research has also indicated protective effects of adolescent self-regulation for decreased substance use (Coskunpinar & Cyders, 2013; Stautz & Cooper, 2013; Wills, Resko, Anette, & Mendoza, 2004). For example, Bandura and colleagues (2001) found that increases in self-regulatory efficacy, both concurrently and longitudinally, were related to reductions in substance use by decreasing antisocial and delinquent behaviors. However, it remains to be seen if adolescent self-regulation is longitudinally influenced by family and parental contextual factors and if adolescent impulse and control systems of self-regulation act as mediators that may explain the link between the context variables of family SES and parental knowledge and the adolescent outcomes.

The Present Study

We hypothesized the following using two waves of longitudinal data. First, we hypothesized that both Wave 1 parental knowledge and Wave 2 adolescent self-regulation would partially mediate the relationship between Wave 1 family SES and Wave 2 adolescent outcomes, and

that Wave 2 adolescent self-regulation would partially mediate the relationship between Wave 1 parental knowledge and Wave 2 adolescent outcomes. We further hypothesized a three-path mediation effect such that lower levels of Wave 1 family SES would be associated with lower levels of Wave 1 parental knowledge, which in turn would be related to lower levels of Wave 2 adolescent self-regulation relating to poorer adolescent outcomes at Wave 2. Figure 1 depicts the conceptual model with hypothesized effects. This study presents, to our knowledge, the first investigation regarding the indirect pathways from family SES to adolescent adjustment through parental knowledge and adolescent self-regulation. Finally, in the present study, tests of gender differences were exploratory; therefore, no directions regarding gender differences were hypothesized. In extant literature, although gender differences are not always clear and consistent, some researchers have found that boys may be more vulnerable to the negative effects of economic hardship (Conger, Conger, Matthews, & Elder, 1999) and may be at greater risk for being poor self-regulators, which is related to higher substance use (Wills et al., 2004). Yet, we do not know whether the pathways linking family SES and adolescent adjustment through parenting, self-regulation may differ between boys and girls.

Method

Participants

Participants were part of a longitudinal study conducting research on youth's healthy development. At Wave 1, participants included 357 adolescents between the ages of 10 to 17 years ($M = 13.03$, $SD = 1.91$). A total of 220 adolescents (male = 55%) participated approximately two years later (Wave 2) between the ages of 11 to 18 years ($M = 15.12$, $SD = 1.56$). Adolescents in the sample were 89% White with the other 11% reporting themselves as African-American, Hispanic, or other races. Those who had already attended their first year of college were aged out of the study and were not asked to complete the study a second time. There were 137 participants that did not return for Wave 2 for reasons including: child not invited back due to age or other issues ($n = 24$), too busy ($n = 8$), moved away ($n = 12$), unable to reach ($n = 86$), child not interested ($n = 6$), and child death ($n = 1$). Participants who did not participate in Wave 2 had a lower income ($t = -3.94$, $p < .01$) at Wave 1 than those participants who did not attrite out of the study. Primary caregivers (parents, hereafter) also participated in the study at both waves, and 81–84% of the respondents were mothers, 13–14% of the respondents were fathers, and 3–5% of the respondents were other caregivers at Wave 1 and Wave 2 respectively. Parent ages ranged from 28 to 71 years ($M = 45.92$, $SD = 6.47$) at Wave 2. Of the sample, 91% of parents reported their race as White with the remaining 9% reporting their race as African-American, Hispanic, or other races. Family income ranged from no source of income to earning more than \$200,000 a year and mean family income was between \$35,000 and \$49,000 a year in both waves. Of the sample, 65.4% had an income above \$50,000 a year at Wave 1 while only 2.7% had an income of more than \$200,000 a year. At Wave 1, 12.8% of the sample had an income of \$24,999 or less, roughly equivalent to the poverty threshold of \$21,203 for a family of four (U.S. Census Bureau, 2007). The majority of participants (40.1%) had four household occupants ($M = 4.13$, $SD = 1.14$, Range = 2.00 – 9.00) with 84.4% of the sample having between three and five household occupants at Wave 1.

Procedures

For Wave 1 of the study, participants were recruited from small cities, towns, and rural areas in a southeastern state via letters using address lists purchased from contact companies, email announcements, flyers, notices placed on the internet, or snowball sampling (word-of-mouth). For Wave 2, participants were contacted via letters in the mail and/or by phone using contact information gathered during the first wave of the study. Adolescents and their parents were interviewed privately and simultaneously, and both received monetary compensation. The university's Institutional Review Board approved the current study.

Measures

Demographic and socioeconomic variables—Demographic information such as parent age, race (0 = White, 1 = Ethnic/Racial minority), marital status (answers range from never married, divorced, separated, and married), and number of persons living in the household was gathered from parents at Wave 1 of the study. Parents reported the household income (1 = None, 15 = \$200,000+). In order to create a continuous income variable, we assigned the mean value of the range of incomes to each income group. For analyses, we imposed a boundary on the \$200,000+ category of \$299,999 (consistent with the ranges of other categories). We believed that this imposed boundary would reflect even the highest earning families given that the per capita income of the region studied is 68% of the national average (Appalachian Regional Commission, 2010), and there were only 6 families (2.7%) in this high-earning category. Parents also reported their satisfaction with their income (1 = Very unsatisfied, 4 = Very satisfied), how often they worry about their family's financial situation (1 = Very often, 4 = Never), and how well-off they consider their family (1 = Very poor, 5 = Upper middle class). All variables were coded so that higher values indicated higher family SES. Previous research has found that objective (e.g., per capita income) and subjective (e.g., financial satisfaction) measures of family SES are not perfectly related and may be measuring different aspects of family SES (Newland, Crnic, Cox, & Mills-Koonce, 2013). Thus, the present study extends extant literature by utilizing a latent variable that includes both objective and subjective measures to capture the construct of family SES in a comprehensive manner. A latent factor of family SES was constructed based on per capita income, satisfaction with income, worry about the family financial situation, and how well-off the family was.

Parental knowledge—Parents and adolescents were asked about parental knowledge using the 13-item Child Monitoring Scale (Hetherington & Clingempeel, 1992) at Wave 1. This scale asks how much the parent knows about his/her adolescent's decisions about various aspects of the adolescent's life, such as performance in school, where the adolescent is when not at home, and dating behaviors. Answers on this scale range from (1 = Never knows) to (5 = Always knows). In the current sample, reliability (Cronbach's alpha) was found to be .89 for adolescents' reports of mother's knowledge, .92 for adolescents' reports of father's knowledge, and .88 for parent's report of parental knowledge. Only two adolescents reported on father's knowledge but not on mother's knowledge, whereas 22 adolescents reported on mother's knowledge but not on father's knowledge. A latent factor of parental knowledge was constructed based on adolescent reports of maternal and paternal knowledge and parent reports of knowledge.

Behavioral self-control—The first aspect of self-regulation measured was behavioral self-control. Adolescents were asked to report their ability to behaviorally self-control using the Brief Self-Control Scale (Tangney et al., 2004) at Wave 2. This scale is 13-items and asks how typical each statement is of the adolescent using a Likert scale ranging from (1 = Not at all) to (5 = Very much). Examples of questions are “I am good at resisting temptation” and “I wish I had more self-discipline.” In the current sample, reliability was .83.

Delay discounting—The second aspect of self-regulation examined in the present study was delay discounting. Adolescents filled out the 27-item Kirby Monetary Choice Questionnaire (Kirby, Petry, & Bickel, 1999) at Wave 2. This questionnaire measures impulsivity in the form of delay discounting. On the Kirby Monetary Choice Questionnaire, adolescents must choose between a smaller, immediate reward and a delayed, larger reward. From choices on the Kirby Monetary Choice Questionnaire, a discount rate for each adolescent was calculated. Possible non-transformed discount rate values can range from .00016 to .25 and measure to what extent a person values a future reward. In general, the present value of a monetary reward decreases as a person must delay gratification for longer periods to receive that reward. Due to space limitations, we do not discuss scoring in detail, but suggest Kirby (2009) for additional scoring information. Because people generally become less impulsive as reward amounts increase, the Kirby Monetary Choice Questionnaire was scored by grouping rewards into three sizes: small (\$25–\$35), medium (\$50–\$60), and large (\$75–\$85). The small reward amount questions were utilized in the present study because medium and large reward sizes were not sensitive to differing levels of impulsivity, which is consistent with the review that people generally become less impulsive as reward amounts increase (Kirby, 2009). In addition, due to the non-normal distribution (i.e., skewness values greater than 3 and kurtosis greater than 10, Kline, 1998), we log-transformed the delay discounting variable. Test-retest reliability for this measure has been found to be .77 over 5 weeks and .71 over 1 year (Kirby, 2009).

Academic performance—Adolescents and parents were asked to report the adolescent’s overall grade point average in school at Waves 1 and 2. Answers were reported in the form of a letter grade ranging from (F = 1) to (A = 5). A composite variable of the average of both adolescent and parent reports was used as an outcome in the present study.

Substance use—Adolescents completed a questionnaire regarding their use of cigarettes, alcohol, and marijuana at Waves 1 and 2. Adolescent participants answered separately for use in each drug category (1 = Never used, 6 = Usually use every day). We performed confirmatory factor analyses (CFA) to for the latent factor of substance use. Due to the non-normal distribution (i.e., skewness > 3 and kurtosis > 10, Kline, 1998), we log-transformed each category of substance use before conducting a CFA. Based on significant factor loadings (.63 to .89, $p < .001$), we averaged individual items scores to create a substance use composite.

Results

Data Analysis Strategy

Structural Equation Modeling (SEM) analyses were conducted using Mplus Version 7.2 statistical software package (Muthén & Muthén, 2010) using Bootstrapping Maximum Likelihood estimation, which utilizes Full Information Maximum Likelihood (FIML) estimates for missing data (Arbuckle, 1996). The significance of mediation effects were tested using bias-corrected bootstrap confidence intervals for the two-path (single mediator) and three-path (two mediators in a series) mediated effects (Preacher & Hayes, 2008). Bias-corrected bootstrap confidence intervals have more power than the Delta method in smaller sample sizes (Preacher & Hayes, 2008). Scores on both the Brief Self-Control Scale and the Kirby Monetary Choice Questionnaire were included as separate mediators in the analyses. The first two-path test determined if parental knowledge was a significant mediator of the relationship between family SES and adolescent self-regulation. The second two-path test determined if adolescent self-regulation was a significant mediator of the relationship between parental knowledge and adolescent academic achievement. The third two-path test determined if adolescent self-regulation mediated the relationship between parental knowledge and adolescent substance use. Finally, the three-path mediation tests determined the significance of the effects of family SES on adolescent academic and substance use outcomes through the two mediators of parental knowledge and adolescent self-regulation.

Table 1 presents bivariate correlations among study variables as well as descriptive statistics. Multivariate general linear modeling analysis revealed no significant effects of any demographic characteristics, including adolescent age, gender, and race as well as parent marital status on study variables ($p = .32 - .89$); thus, they were not included in the main analyses. Given that our sample included adolescents of a wide range of age, we tested a nested model to determine if any age differences existed between younger (under 15 years) and older (equal to or above 15 years) adolescents. Two-group SEM analyses testing for age differences between participants below the age of 15 ($N = 107$) and those equal and above the age of 15 ($N = 113$) revealed no significant age differences in the effects of economic hardship (Wald test $\chi^2 = 8.03$, $df = 5$, $p = .15$), parental knowledge (Wald test $\chi^2 = 8.96$, $df = 9$, $p = .44$) or adolescent self-regulation (Wald test $\chi^2 = 23.08$, $df = 21$, $p = .34$) on any variables they were predicting. Finally, because of the theoretical distinction of delay discounting and behavioral self-control representing two distinct aspects of self-regulation as well as the near-zero correlation ($r = -.05$) between these two variables, the covariance between delay discounting and behavioral self-control was not included in the SEM analyses.

We examined how Wave 1 family SES was related to Wave 1 parental knowledge and Wave 2 adolescent self-regulation, academic, and substance use outcomes. In all analyses, we included paths from academic performance and substance use at Wave 1 to behavioral self-control, impulsivity, academic performance, and substance use at Wave 2 to control for the base line levels of outcome variables. We also tested a nested model where path coefficients were constrained to be equal for both males and females to examine possible gender differences. We first tested whether the effects of family SES were equivalent across the

gender groups. Next, we tested the equality of the effects of parental knowledge. Finally, we tested the equality of the effects of self-regulation.

In evaluating the overall goodness of fit of each model, overall model fit indices were examined using the following measures: (1) χ^2 value, (2) degrees of freedom, (3) corresponding p-value, (4) Root Mean Square Error of Approximation (RMSEA), and (5) Confirmatory Fit Index (CFI). As a process of understanding sources of good vs. ill fit in a model, we followed the guideline that RMSEA values of less than .05 can be considered very good and values less than .08 were considered acceptable (Browne & Cudeck, 1993), and CFI values greater than .95 can be considered a very good fit between the hypothesized model and the observed data (Hu & Bentler, 1999).

Hypothesis Testing

In terms of testing measurement models of family SES and parental knowledge latent factors, model fit statistics for the latent variable of family SES were $\chi^2 = 6.92$, $df = 2$, $p = .03$, CFI = .97, RMSEA = .10, with standardized factor loadings ranging from .55 to .78 indicating an acceptable model fit. The measurement model for parental knowledge was a saturated model with $\chi^2 = .00$, $df = 0$, $p = .00$, CFI = 1.00, RMSEA = .00, with standardized factor loadings ranging from .23 to .99. Our hypothesis model examined the association between family SES at Wave 1 and adolescent academic and substance use outcomes at Wave 2 as mediated by Wave 1 parental knowledge and Wave 2 adolescent behavioral self-control (Brief Self-Control Scale) and delay discounting (Kirby Monetary Choice Questionnaire). The model included Wave 1 academic performance and substance use as covariates to control for the baseline levels of the outcomes and had a $\chi^2 = 72.54$, $df = 46$, $p = .01$, CFI = .95, RMSEA = .05, indicating a good fit. As presented in Figure 2, higher Wave 1 family SES was related to higher levels of Wave 1 parental knowledge ($b = .13$, $SE = .05$, $p = .04$). Higher parental knowledge at Wave 1 was associated with higher adolescent behavioral self-control ($b = .26$, $SE = .11$, $p = .03$) and lower substance use at Wave 2 ($b = -.33$, $SE = .12$, $p = .05$). Higher behavioral self-control was related to better academic performance ($b = .13$, $SE = .07$, $p = .05$) and lower substances use ($b = -.42$, $SE = .08$, $p < .001$), whereas higher delay discounting was related to poorer academic performance ($b = -.09$, $SE = .03$, $p = .002$) and higher substance use ($b = .07$, $SE = .03$, $p = .03$).

For testing significance of mediated effects, we utilized the bias-corrected bootstrap confidence interval. There were significant two-path mediation effects between family SES and adolescent substance use through parental knowledge ($b = -.04$, $SE = .02$, $Z = -1.94$, 95% CI $[-.146, -.011]$), between parental knowledge and substance use through behavioral self-control ($b = -.11$, $SE = .05$, $Z = -2.21$, 95% CI $[-.244, -.045]$), and between parental knowledge and academic performance via behavioral self-control ($b = .04$, $SE = .02$, $Z = 1.57$, 95% CI $[.008, .101]$). In addition, the three-path mediational pathway of family SES to adolescent substance use through parental knowledge and adolescent behavioral self-control was significant ($b = -.02$, $SE = .01$, $Z = -1.73$, 95% CI $[-.049, -.005]$), and the three-path mediation effect of family SES on academic performance through parental knowledge and behavioral self-control ($b = .01$, $SE = .00$, $Z = 1.37$, 95% CI $[.001, .020]$) was also significant.

Gender differences—The two-group SEM analyses indicated no significant gender differences in the effects of economic hardship (Wald test $\chi^2 = 1.58$, $df = 5$, $p = .90$), parental knowledge (Wald test $\chi^2 = 5.67$, $df = 9$, $p = .77$) or adolescent self-regulation (Wald test $\chi^2 = 22.58$, $df = 21$, $p = .37$) on adolescent outcomes.

Discussion

The present study extended the family stress model of economic hardship by testing two serial mediating processes of parental knowledge and adolescent self-regulation in the link between family SES and adolescent academic and substance use outcomes. First, we found that family SES positively predicted parental knowledge. Second, we found that parental knowledge positively predicted adolescent behavioral self-control and negatively predicted substance use. Finally, greater adolescent self-regulation – high behavioral self-control and low delay discounting – was associated with better academic performance and lower substance use.

The results of the present study provide support for a dual systems (Bechara, 2005; Carver, 2005) approach to studying adolescent self-regulation. The findings are consistent with a recent study demonstrating differential effects of good self-control and poor regulation on alcohol related outcomes among college students (Pearson, Kite, & Henson, 2013). The present study adds to extant theory by demonstrating the differential effects of behavioral self-control (the control system) and delay discounting (the impulse system) on adolescent academic and substance use outcomes. Our results highlight that these two systems do work in tandem to influence not only substance use development but also academic achievement among adolescents.

The significant mediated effects of family SES on adolescent substance use through parental knowledge are consistent with the family stress model of economic hardship (Conger & Conger, 2002), which emphasizes that developing children/adolescents are affected indirectly by economic hardship through poor parenting behaviors. Our findings illustrate that adolescents receiving low parental monitoring, as indicated by poor parental knowledge, may have difficulty with self-control development, and these adolescents are likely to show low levels of academic performance and high levels of substance use. Parents who showed greater awareness and supervision of adolescents' activities might be more likely to intervene in unhealthy, dysregulated behaviors in their adolescents, resulting in helping them to resist temptation to use substances and may be more likely to engage in other supportive parenting. In addition, parents with greater knowledge of their adolescents' behavior may guide and reinforce the development of good adolescent self-regulation (Crossley & Buckner, 2012). Previous research does indicate that parental warmth can positively influence the development of self-regulation in children (Vazsonyi & Huang, 2010). Our findings further emphasize the important role of parental knowledge in the development of adolescent behavioral self-control and highlight the joint protective effects of parental knowledge and adolescent self-regulation against adolescent maladjustment outcomes. Furthermore, this study presents the first evidence to show a three-path mediated effect of family SES to adolescent academic achievement through parental knowledge and adolescent behavioral self-control. This finding suggests that prevention and intervention efforts should

target both the parent and the adolescent in order to best promote high adolescent academic performance, especially in a low family SES environment.

Consistent with extant research (Steinberg et al., 2009), family SES was not directly predictive of delay discounting. Possible effects of parental knowledge on adolescent delay discounting have not been tested in previous studies. We found that parental knowledge was not a significant predictor of delay discounting, which is consistent with extant literature in preschoolers that parental warmth was not related to delay ability (Lengua et al., 2014). Prior research has identified intrapersonal predictors of delay discounting such as working memory (Bickel, Yi, Landes, Hill, & Baxter, 2011) and religiousness (Kim-Spoon et al., 2013), but future research should consider other plausible interpersonal predictors of delay discounting (including social relationship) to better understand how intrapersonal and interpersonal factors interface with each other to influence the development of delay discounting.

The present findings make unique and important contributions to extant literature in several ways. First, we examined both objective and subjective measures of family SES to capture the differing aspects of the family SES. Second, as suggested by recent research, low family SES can have wide-sweeping consequences on adolescent self-regulation (Evans & Kim, 2013); yet, most prior research fails to examine multiple aspects of self-regulation. The present study furthered extant research by examining two theoretically important aspects of adolescent self-regulation: behavioral self-control and delay discounting. Third, we examined adolescent academic performance and substance use simultaneously in the same model, which was vital to compare the pathways leading to positive versus negative adolescent outcomes. Fourth, multiple-path mediation analyses (involving serial mediators) have not been systematically examined encompassing family SES, parenting, and adolescent self-regulation and adjustment outcomes in extant literature. Finally, the present study extended the family stress model of economic hardship to an understudied Appalachian population. Although the population utilized in the present study was not highly diverse, the sample composition is typical of the Appalachian area in which it was collected (U.S. Census Bureau, 2011). This rural area is understudied, and as the per capita income in the Appalachian region is only 68% of the national average and approximately 18% of individuals are below the poverty line (Appalachian Regional Commission, 2010). As adolescents in this region may be potentially more vulnerable to poor adjustment outcomes, this region provides an important geographical area to study the effects of family income and family processes.

Despite these strengths, some limitations regarding the present study should be noted. First, families with a lower income were less likely to return to Wave 2, and such differential attrition may have biased our results although utilizing the analysis method of FIML should minimize this bias. Second, adolescent self-regulation and substance use were measured solely using self-reports. Third, we acknowledge that there might be third variables (such as IQ or stress) that may be responsible for the significant relationships found in our models. Fourth, a bidirectional relationship might exist between parental monitoring and adolescent adjustment such that parental monitoring may be affected by adolescent adjustment (e.g.,

Kerr, Stattin, & Zdemir, 2012). Fifth, our data involved only two waves and were thus limited for rigorously testing mediational effects.

In conclusion, the results of the current study provide a valuable and unique contribution to extant literature by expanding the understanding of the pathways through which family SES can influence adolescent adjustment. Understanding how the relationship between family SES and adolescent adjustment may be mediated by parental knowledge and adolescent self-regulation is the first step toward being able to influence this relationship for the development of effective intervention and prevention among adolescents at risk for the detrimental effects of family economic disadvantages. The current findings further highlight the crucial roles of parental knowledge in bolstering adolescent academic performance as well as undermining substance use. Parental knowledge appears to be a particularly valuable intervention point considering that adolescents who experience high levels of parental knowledge have not only the direct benefits of this knowledge on substance use, but they additionally experience the indirect benefits of parental knowledge on the substance use and academic outcomes through enhanced behavioral self-control.

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Figure 1.

The hypothesized relationships among family socioeconomic status, parental knowledge, behavioral self-control, delay discounting, and adolescent adjustment outcomes.

Figure 2.

Model fitting results of family socioeconomic status, parental knowledge, behavioral self-control, delay discounting, and adolescent adjustment outcomes.

Note. Primary Knowledge is the report of the primary caregiver. Bold lines indicate significance at $*p < .05$. Numbers on paths are unstandardized coefficient (SE)/standardized coefficient.

Table 1

Bivariate Correlations and Summary Statistics of Study Variables

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Plnc1													
2. ISat1	.37*												
3. FWell1	.55*	.44*											
4. FWor1	.32*	.42*	.42*										
5. MKno1	.05	.09	.15*	.04									
6. FKno1	.05	.09	.24*	.09	.69*								
7. PKno1	-.13	-.00	.03	.05	.23*	.15*							
8. AP1	.20*	.09	.09	.05	.17*	.20*	-.02						
9. SU1	-.01	-.07	.01	-.09	-.21*	-.20*	-.09	-.09					
10. DD2	-.05	-.06	-.07	-.06	-.07	-.07	.08	-.08	.06				
11. BSC2	.06	.08	.14*	.15*	.18*	.22*	.11	.17*	-.04	-.05			
12. AP2	.17*	.15*	.20*	.13	.14*	.15*	.02	.61*	.02	-.23	.24		
13. SU2	-.05	-.12	-.06	-.08	-.32*	-.25*	-.14*	-.21*	.39*	.17*	-.40*	-.25*	
<i>M</i>	1.85	2.77	3.83	2.42	4.60	4.37	4.60	4.21	.77	-4.41	3.50	4.05	1.49
<i>SD</i>	1.32	.73	.67	.73	.56	.67	.49	.64	.19	1.42	.63	.75	.82
Range	.01–8.33	1.00–4.00	1.00–5.00	1.00–4.00	1.15–5.00	1.46–5.00	1.31–5.00	2.50–5.00	.00–1.75	-8.75–1.40	2.08–4.85	2.00–5.00	1.00–5.33
<i>N</i>	220	219	219	219	218	201	220	220	219	220	220	218	212

Note. Plnc1 = Per capita income Wave 1, ISat1 = Income satisfaction Wave 1, FWell1 = Financial well-off Wave 1, FWor1 = Financial worry Wave 1, MMon1 = Maternal knowledge Wave 1, FMon1 = Paternal knowledge Wave 1, PMon1 = Parent knowledge Wave 1, AP1 = Academic performance Wave 1, and SU1 = Substance use composite Wave 1, DD2 = Delay Discounting Wave 2, BSC2 = Behavioral self-control Wave 2, AP2 = Academic performance Wave 2, and SU2 = Substance use composite Wave 2.

* $p < .05$