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The Importance of Parenting in the Development of Self-control During Childhood, Early Adolescence, and Late Adolescence

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Abstract
The current investigation tested changes in low self-control and the developmental links between parenting and the developmental course of self-control. It was hypothesized that (1) low self-control would change over time (within individual changes); (2) parenting would negatively predict both the intercept and slope of low self-control during childhood; (3) parenting would negatively predict only the intercept during early and late adolescence. Self-report data from the Korean Children and Youth Panel Survey (KCYPS) were used, from the (1) first-grade elementary school panel (childhood; $N=2342$), (2) the fourth-grade elementary school panel (early adolescence; $N=2378$), and the (3) first-grade junior high school panel (late adolescence; $N=2351$). Second-order latent growth curve models provided support that low self-control decreased over time. Findings also partially supported hypothesis 2, as parenting negatively predicted the intercept of low self-control, not the slope. Finally, they supported hypothesis 3, as a significant negative parenting effect predicted the low self-control intercept during both early and late adolescence. The current study contributes to research on the link between positive parenting and low self-control development, tested across three distinct developmental periods or age groups and by studying these questions among Korean youth.

Keywords Self-regulation · Self-control theory · Warmth · Cross-cultural

Introduction

Gottfredson and Hirschi (1990) provided a fairly detailed explanation on the development of self-control, in effect, everything that can go awry during the socialization of a child with missing parental controls, resulting in low levels of self-control. That self-control is critical not only for crime and deviance, but also for what Gottfredson and Hirschi (2020) call "stronger life opportunities for a wide range of outcomes" (p. 228), requires little explanation today (see also Moffitt et al., 2011). The starting point for a positive and successful socialization experience includes an affectively positive and close relationship with parents or caregivers. In the absence of this primary relationship and bond, parents are less likely to monitor children's behaviors, identify norm violations and deviance, and less likely to correct and punish such behaviors. As described at length by Vazsonyi et al. (2015), Gottfredson and Hirschi acknowledge the importance of inherent individual differences in self-control, of differences in effect present at birth, and thus, differences in crime and deviance. In fact, based on the accumulating behavior genetic research, half to two-thirds of the variability in self-control can be attributed to individual differences anchored in heritable materials (Boisvert et al., 2012; Coyne & Wright, 2014; Willems et al., 2018; Wright & Beaver, 2005), but also more generally familial factors (Boutwell & Beaver, 2010; Nofziger & Newton, 2018). Similarly, Beaver et al. (2013) found that genetic factors accounted for 74% to 92% of the stability as well as 78% to 89% of the change in self-control over time. Focusing mostly on the stability issue in self-control, Diamond (2016) also found fairly consistent evidence of stability based on a young adult sample as did Nofziger and Johnson (2020) based on data from the NLSY from the United States as well as Yun and Walsh (2011) based on a Korean late adolescent sample.

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However, Gottfredson and Hirschi choose to focus on the importance of socialization experiences in the development of self-control, on the potential malleability of self-control, that is largely dependent on both social controls present in a child's life, predominantly during the first decade of life. This defines and outlines the focus of the present investigation which seeks to contribute to continued gaps in the literature focused on the developmental influences and developmental course of self-control over time, both during the first as well as the second decades of life. More specifically, the present study sought to contribute to the literature by testing the extent to which early positive parenting predicted both initial status (across childhood, early adolescence, and late adolescence) and the slope or developmental changes (during childhood, but not during early and late adolescence, based on theory) in self-control over time. For this purpose, three samples were used that covered the first and second decades of life, childhood, early adolescence, as well as late adolescence. The study also addressed an important original tenet by Gottfredson and Hirschi, namely the extent to which theoretical predictions find cross-cultural applicability (see also Gottfredson, 2021).

Literature Review

Over 15 years ago, Wright and Beaver (2005) lamented on status of research and the paucity of work that had focused on how self-control developed, how the presence or absence of socialization pressures, mostly parenting, shaped self-control. The situation has improved only some, and there exist a modest number of studies that have directly tested this question (Nofziger, 2008; Vazsonyi & Huang, 2010), and number of them have tested indirectly (Forrest et al., 2019 testing the dual system model; Nofziger & Newton, 2018 tested intergenerational transmission; and Meldrum & Hay, 2012 focused on peer effects on self-control), using necessary developmental conceptualizations and longitudinal data as well as matching developmental analytic techniques. Theoretically, Gottfredson and Hirschi make the case that socialization effects matter most during the first decade of life for the development and establishment of self-control, less so (but they do not claim no effects) during adolescence and beyond. Piquero et al. (2010) have in part substantiated this through the evidence from their meta-analysis focused on programmatic efforts to improve self-control among children under the age of 10.

A number of scholars have interpreted this to mean that self-control is immutable following childhood and cannot or should not change past age 10 or so. Logically, if low self-control is a key probabilistic correlate and predictor of crime and deviance, if we can accept the ubiquitous age-crime and deviance link (Hirschi & Gottfredson, 1983), then it follows that much like the levels of crime and deviance rise past the age of 10 to peak around late adolescence or young adulthood, only then to once again decline throughout adulthood, as a function of age alone (Gottfredson & Hirschi, 2020), that *levels* of self-control might also change. This has been strongly supported by pioneering neuroimaging studies mapping age-graded, non-linear developmental changes during adolescence (Casey et al., 2011) as well as by tests of these findings on how different elements of self-control continue to change (sensation seeking rises rapidly), while others less so, initially at least, framed by the dual systems model (impulse control slowly improves until mid-twenties; see Vazsonyi & Ksinan, 2017). This does not mean nor address whether or not parenting might have "some" continued effects on between individual differences in low self-control past the age of 10 (for evidence supporting some effects based on parenting during infancy, see Vazsonyi & Javakhishvili, 2019). Gottfredson and Hirschi (2020) never made a statement that it could not, but simply note on between individual or rank-order stability.

> We did not say, nor do we say now, that the strength of self-control does not or cannot change over time. We say instead that *once established*, differences between individuals *tend* to remain stable over the life course. We also say that *once established*, high levels of self-control do not appear to dissipate much with age (p. 79).

Others have tested this question using analytic approaches that are simply unable to fully address the question (for instance, using two assessment points, using adolescent samples only or adult samples only, or using data-driven, group-based, or taxonomic trajectory models).

In fact, on the latter issue, Skardhamar (2010) calls the use and application of group-based, data-driven trajectory modeling into question, commenting that it simply is unable to address and test specific questions, largely because "latent classes may capture systematic and random variation alike, in addition to variation resulting from sample bias and unobserved variables" (p. 313). It is a purely data-driven approach that cannot, by definition, provide much evidence for or against a particular set of study hypotheses, a problem that is common across all exploratory statistical methods. Skardhamar noted that group-based trajectory modeling "is a 'theory free method' and that groups 'emerge from the data set itself' is just another way of saying strictly exploratory" (p. 313). Thus, using data-driven group-based trajectory modeling techniques do not seem well positioned to inform the ongoing discourse on testable predictions made by self-control theory (e.g., Diamond, 2016; see Gottfredson & Hirschi, 2020 for a cogent discussion of this and related topics).

Changes in Self-control

Returning to Gottfredson and Hirschi's theoretical predictions, they do suggest that socialization effects on self-control should occur primarily during the first decade of life, in effect a critical period for self-control development; they do suggest that self-control, once established due to both individual differences as well as socialization pressures from caregivers, but also from secondary sources, such as the school or the neighborhood youth reside in, by about age 10, should remain *largely* stable over time, that is rank-order stability (between individual differences), but not within individual changes (cf, Meinert & Reinecke, 2018 for a different interpretation), however; and they do maintain the immutable age-crime link, which would predict that absolute levels or within individual differences of low self-control should "improve" over the lifecourse, following a peak in late adolescence, thus resulting in the observed aging out effect among the most serious offenders long-term (see Vazsonyi & Huang, 2010, for baseball pitcher analogy). As noted, in the short-term, however, during the second decade of life, this same process would result in some continued level changes in self-control, likely much less pronounced following childhood, *namely further declines in self-control*, due to parallel well-known increases in crime and deviance until a peak around the age of 17 or 18 (Gottfredson & Hirschi, 2020; Hirschi & Gottfredson, 1983). Conversely, testing self-control changes over time between the ages of 4.5 and 15 years, Vazsonyi and Jiskrova (2018) found no such evidence past age 10.5 years. The current study, although not testing the same question on one sample, tests the parallel question on three samples, one from childhood, one from early adolescence, and one late adolescence.

Again, few studies have tackled the full complement and complexity of these theoretical predictions, for the previously noted reasons, but have instead focused mostly or exclusively on the rank-order stability (between individual differences) issue of self-control, for instance, (Beaver & Wright, 2007; Coyne & Wright, 2014; Diamond, 2016; Jo, 2015; Yun & Walsh, 2011) or have conflated the between and within individual difference changes over time, or have erroneously interpreted theory as predicting no additional changes at all in self-control during the second decade of life and beyond. Some of this work has provided evidence supporting rank-order stability (Arneklev et al., 1998; Coyne et al., 2015; Diamond et al., 2015; Hay & Forrest, 2006; Ray et al., 2013; Turner & Piquero, 2002), while work has not (Burt et al., 2006, 2014; Meinert & Reinecke, 2018; Mitchell & MacKenzie, 2006; Na & Paternoster, 2012; Winfree, et al., 2006).

Parenting and Changes in Self-control

Based on a sample of over 1000 children and their caregivers, Vazsonyi and Huang (2010) found that age 4.5-year parental warmth predicted the initial status, and contrary to expectations, not the slope or developmental change in self-control, over a 6-year period from ages 4.5 years to 10.5 years. This provided some evidence that something else was responsible for the observed developmental changes in self-control, perhaps something even prior to age 4.5 years that might include either parenting or individual differences, or both. Vazsonyi and Javakhishvili (2019) further investigated this question by testing whether parenting measures assessed *during infancy*, during the first 3 years of a child's life, using observational methods, accounted for unique variance in developmental changes in self-control over time, from ages 4.5 to 15. They found that attachment (Bowlby's attachment styles) only explained developmental changes in self-control until age 8.5 years (including age 4.5 years); parental sensitivity (assessed at age 6 to 15 months) uniquely explained developmental changes in self-control at age 8.5 years and age 15. Finally, the HOME measure (assessed between age 6 months to 15 months), a well-known measure of the home environment and associated parenting, predicted developmental changes in self-control at age 4.5 years and age 11.5 years. Thus, there is some evidence that some home environment or parenting measures *rated by observers* during the first 3 years of life explained variability in developmental changes in self-control beyond the age of 10, during adolescence.

In conclusion, the evidence appears clear about the importance of socialization effects on the development of self-control during the first decade of life, with some evidence on its importance also beyond childhood. Most research focusing on childhood has provided evidence that is substantively consistent with theoretical predictions. The evidence appears to be more complex when it comes to the importance of socialization effects on potentially continued developmental changes in self-control during the second decade of life and beyond, although Li et al. (2019), based on a three-level meta-analysis of 191 studies focused on the cross-sectional and longitudinal links between parenting and self-control found evidence that parenting was associated both concurrently and longitudinally with self-control (and vice versa, bidirectionally), and that observed effect sizes were independent of culture, ethnicity, and importantly, the developmental stage of adolescents. The evidence from individual studies appears to be dependent on sample studied, number of assessments employed, as well as analytic techniques implemented, either purely data-driven or ones more consistent with hypothesis testing. It is important to note that most evidence on developmental changes in self-control in longitudinal data sets related to socialization

effects has been based on North American samples and this question has not been tested much across different cultural developmental contexts (cf., Meinert & Reinecke, 2018). Gottfredson and Hirschi (1990) daringly proposed that their theory should find empirical support and applicability across different ethnic and racial groups, but also across different cultural and national contexts. The evidence based on cross-sectional data that has followed since testing this proposition has largely been consistently supportive of this prediction. However, there have been few efforts outside of North America that have tested these essentially developmental questions about how self-control develops during the first as well as the second decade of life and whether changes in self-control are associated with earlier parenting efforts or not. This then is where the current investigation also sought to make a substantial contribution.

The Present Study

The purpose of the current investigation was to address remaining gaps in the extant literature. More specifically, the present study contributes to the literature by testing the extent to which self-control (within individual changes, or levels) continues to change over the course of childhood and adolescence. The ubiquitous link between age and crime proves highly informative for this, which would lead to the simple, yet profound expectation that self-control must also continue to change (levels) over the life course, albeit with very few (between individual) changes (rank-order stability) which are established early in life, around age of 10 years. In addition, based on and consistent with theory, it can be expected that these changes are the most profound or large during childhood and much more modest during adolescence.

The present study also contributes to the literature by testing the extent to which early positive parenting predicted both the initial status (childhood, early adolescence, and late adolescence) and developmental changes (childhood only, but not during early or late adolescence) in self-control over time. To do so, three different samples of youth were used which cover the first two decades of life, namely childhood, early adolescence, as well as late adolescence. In addition, and consistent with original theoretical work by Gottfredson and Hirschi (1990), the study tested these questions in three South Korean samples, (see also Gottfredson, 2021). The three following study hypotheses were tested, based on theory and the age–crime relationship:

A. It was hypothesized that self-control levels would change over time (unconditional growth model) across all three age groups, during childhood, early adolescence, and late adolescence (within individual changes), with much more modest changes during adolescence in comparison to childhood.

B. To address whether positive parenting predicted initial status and developmental changes in self-control (conditional growth model) during childhood, it was hypothesized that positive parenting would account for significant variability at the initial status of self-control as well as significant amounts of variance in self-control growth (slope) over time.

C. Finally, it was also expected that parenting would explain only variability at initial status in the early adolescent and late adolescent samples of youth, with few or no significant links with developmental changes or the slope during adolescence.

Method

Sample and Procedures

Data for the current study were obtained from a nationally representative study of the Korean Children and Youth Panel Survey (KCYPS), conducted by the National Youth Policy Institute (NYPI) (see http://archive.nypi.re.kr/ for more information on data). The KCYPS was a longitudinal panel survey over a 7-year period (2010–2016) from three panels, namely (1) first-grade elementary school students (childhood), (2) fourth-grade elementary school students (early adolescence), and (3) first-grade junior high school students (US equivalent of 7th grade, late adolescence) regarding children and adolescents' growth and development. The KCYPS sample was selected using a multi-stage stratified cluster sampling design, based on 2009 National School Statistics of the Ministry of Education in 16 administrative districts (including Seoul metropolitan city and 15 metropolitan cities and provinces) of South Korea. Standard ethical procedures were followed consistent with the Declaration of Helsinki and the World Health Organization related to human subjects protections, which included active parental consent for child participation.

Schools were selected as the primary sampling unit, using probability proportional to size (PPS) sampling, based on the average number of students per class for the first wave (2010). Of the 271 schools in total, 174 schools (64%) participated during the first round of contact (57% for the first-grade elementary school panel (childhood); 64% for the fourth-grade elementary school panel (early adolescence); 73% for the first-grade junior high school panel (late adolescence). A total of 6600 students (2200 per panel) were sampled from 174 selected schools, sampled proportionately to their sizes based on the average number of students per class for the first wave (2010). Students and their parents were sampled proportionately to the number of students enrolled in selected schools. A face-to-face survey and self-reported assessments were administered to students in the schools, whereas a telephone survey was given to their parents or

guardians. For the second wave (2011), individual interviews with the participants were conducted after locating each student who participated during the first survey period in 2010. The procedures of data collection from the third wave to the seventh wave were the same as those for the second wave.

In total, 2342 students were selected for the first-grade elementary school panel (childhood), 2378 students were for the fourth-grade elementary school panel (early adolescence), and 2351 students were for the first-grade junior high school panel (late adolescence) from 2010 in the first wave. The KCYPS conducted a total of seven surveys on 7071 original samples confirmed in 2010. In the final survey, 5862 students were successfully sampled, and the final retention rate was 82.9% (85.5% for the first-grade elementary school panel; 83.2% for the fourth-grade elementary school panel; 80.0% for the first-grade junior high school panel). Low self-control questionnaires were completed from Waves 2 to 7 (except Wave 5) of the first-grade elementary school panel, Waves 3 to 7 (except Wave 4) of the fourth-grade elementary school panel, Waves 2 to 7 (except Wave 5) of the first-grade junior high school panel.

To compare findings across the three different developmental periods—late childhood, early adolescence, and late adolescence—Waves 2, 3, and 4 of the first-grade elementary school panel (ages 8, 9, and 10) were selected to represent late childhood, Waves 3, 5, and 6 of the fourth-grade elementary school panel for early adolescence (ages 12, 14, and 15), and Waves 3, 4, and 6 of the first-grade junior high school panel for late adolescence (ages 15, 16, and 18). Parenting questionnaires were selected from Wave 2 of the first-grade elementary school panel and Wave 3 for the fourth-grade elementary and first-grade junior high school panels. This is because the first- and second-year survey data did not include parenting. The attrition rates were 6.2% of the first-grade, 6.7% of the fourth-grade, and 8.6% of the seven-grade student panel data.

Missing data analysis and comparisons between youth who remained in the study versus ones who did not provide evidence of some significant differences: annual income ($p = 0.024$) for the 1st elementary school panel; biological parents ($p = 0.033$) for the 4th elementary school panel; father's education level ($p = 0.002$), father's job type ($p = 0.022$), and annual income ($p = 0.$ 0.024) for the 7th junior high school panel. Importantly, mean-level comparisons of the focal variables (parenting and low self-control) in each of the three cohorts, comparing youth who participated in all three waves versus ones who dropped out in waves 2 and 3, respectively, provided evidence of no significant differences. All variables for the main study analysis are described in Table 1.

Measures

Demographic Variables

Sex, family structure, and family SES were included as control variables in data analyses. Sex was a dichotomous variable (males: 51%, females: 49%). Family structure was recoded into 1 for two biological parents (87%) and 0 for other (13%), based on 9 original categories (both biological father and mother, only biological father, only biological mother, biological father and stepmother, biological mother and stepfather, both stepfather and mother, only stepfather, only stepmother, and no parents). Family socioeconomic status (SES) was captured by using five indicators: (1) parents' level of educational attainment (five categories ranging from "low or middle school" to "graduate school"), (2) job title(s) of parents (four categories ranging from "laborer, production worker" to "owner of a business, professional"), and family annual household income (six categories ranging from "10,000,000 won or less" to "90,000,000 won or more," where 1100 won = 1 US$). Each variable was standardized scores and combined into a composite score, where higher scores indicated higher levels of family SES. Age was excluded from this analysis since the sample consisted of students from the same grade. Race also was omitted as South Korea is a racially homogeneous nation.

Dependent Variable

Low self-control was assessed by five items, asking participants to rate the following statements: (1) I lose my temper pretty easily, (2) I like to get out and do things more than I like to read or contemplate ideas, (3) When things get complicated, I tend to quit or withdraw, (4) I sometimes find it exciting to do things for which I might get in trouble, and (5) I almost always feel better when I am on the move than when I am sitting and thinking (Tittle et al., 2003). Participants rated each item on a four-point Likert scale, ranging from 1 (*very untrue*) to 4 (*very true*). Reliability estimates ranged from 0.76 to 0.80 for Waves 2, 3, and 4 for the children; from 0.76 to 0.79 for Waves 3, 4, and 6 for early adolescents; and from 0.71 to 0.79 for Waves 3, 4, and 6 for late adolescents.[1] A principal component analysis (PCA) and confirmatory factor analysis (CFA) were conducted to

[1] In the 1st grade students data, questions for low self-control were asked respondents at Waves 2, 3, 4, 6, and 7, but items only at Waves 2, 3, and 4 (between ages 9 and 11) were used for the childhood. In the 4th grade students data, items were assessed at Waves 3, 5, 6, and 7, but we used items only at Waves 3, 4, and 6 (between ages 13 and 16) for early adolescence. In the 7th grade students data, items were collected at Waves 2, 3, 4, 6, and 7, but items were used only at Waves 3, 4, and 6 (between ages 16 and 19) for late adolescence.

Table 1 Descriptive Statistics of the Three Study Samples

Items		Childhood (8, 9, and 10 years)						Early adolescence (12, 14, and 15 years)						Late adolescence (15, 16, and 18 years)					
		Wave 2		Wave 3		Wave 4		Wave 3		Wave 5		Wave 6		Wave 3		Wave 4		Wave 6	
		Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D
Low self-control (LSC)																			
LSC1	1 = very untrue	2.29	0.74	2.38	0.80	2.12	0.71	2.35	0.82	2.12	0.76	2.09	0.73	2.38	0.80	2.12	0.71	2.05	0.69
LSC2	2 = untrue	2.51	0.78	2.64	0.79	2.40	0.74	2.46	0.85	2.39	0.78	2.39	0.78	2.64	0.79	2.40	0.74	2.33	0.74
LSC3	3 = true	2.50	0.82	2.60	0.82	2.46	0.76	2.46	0.87	2.43	0.80	2.38	0.78	2.60	0.82	2.46	0.76	2.37	0.71
LSC4	4 = very true	2.47	0.80	2.53	0.81	2.26	0.75	2.31	0.86	2.21	0.78	2.15	0.76	2.53	0.81	2.26	0.75	2.20	0.74
LSC5		2.36	0.77	2.46	0.80	2.24	0.76	2.17	0.81	2.11	0.79	2.11	0.78	2.46	0.80	2.24	0.76	2.17	0.74
Parenting (PRT)																			
PRT1		2.96	0.89					3.22	0.89					2.97	0.87				
PRT2		3.08	0.75					3.32	0.73					3.11	0.72				
PRT3		3.20	0.72					3.44	0.67					3.23	0.68				
PRT4		3.28	0.70					3.50	0.66					3.31	0.64				
Sex																			
Family structure	0 = female 1 = male	0.51	0.50					0.53	0.50					0.51	0.50				
Family SES	0 = other 1 = biological parents	0.87	0.33					0.91	0.29					0.87	0.33				
	Composite scale	0.24	3.54					0.21	3.53					0.24	3.54				

LSC1 I lose my temper pretty easily, *LSC2* I like to get out and do things more than I like to read or contemplate ideas, *LSC3* when things get complicated, I tend to quit or withdraw, *LSC4* I sometimes find it exciting to do things for which I might get in trouble, and *LSC5* I almost always feel better when I am on the move than when I am sitting and thinking

develop a single construct, where a higher value represented lower self-control.

Independent Variables

Parental care ("parenting") was measured with four items, asking participants' awareness of their parent's ability to care for them. These items included (1) parents in my family thinks that I am more important than their job, (2) parents in my family are interested in my life, (3) parents provide for my clean clothes, and (4) I knew that there was parents in my family to take care of me and protect me.[2] Participants rated these statements on a four-point Likert scale, ranging from 1 (*very untrue*) to 4 (*very true*). Cronbach's alpha reliability estimates were the following: ∝=.542 at Wave 2 for children; ∝=.814 at Wave 3 for early adolescents; ∝=.758 at Wave 3 for late adolescents. The four items were tested using PCAs and CFAs to develop a parenting construct for each cohort. The higher value of the construct reflected higher levels of positive parenting.

Analytical Procedure

This study tested the main study hypotheses using a second-order latent growth curve model, a latent curve analysis, also known as a curve-of-factors model to test the developmental trajectory of low self-control across the three measurement occasions, in three different developmental periods or age groups. This approach is an extension of a conventional latent growth curve model originally proposed by McArdle (1988), to be able to model growth factors (intercept and slope) by using latent constructs at each assessment with as multiple indicators.

The attrition rate (6.2% of the first-grade cohort, 6.7% of the fourth-grade cohort, and 8.6% of the seven-grade cohort of students) was addressed by using the estimator option of analysis command, maximum likelihood estimation with robust standard errors (MLR), indicating all data contribution. Despite "MLR" techniques, for some models, cases with missing values on predictors were excluded, and thus, a numerical iteration algorithm option was specified (Monte Carlo integration) to include cases with missing values on all relevant explanatory variables in the models by utilizing M*plus* 7.4 (Byrne, 2012; McKnight et al., 2007; Muthen & Muthen, 2015).

Analyses proceeded in four steps. First, a first-order factor model (measurement model) was tested by implementing a principal component analysis (PCA), followed by a confirmatory factor analysis (CFA) to develop a lower-order factor of low self-control at each of the three measurement occasions (see Table 2). These factors scores (CFA latent factors) were then used as indicators/repeated measures of a second/higher-order growth curve (structural model), which allowed free estimation of measurement errors and to potentially specify correlated errors. Second, the longitudinal covariance patterns were tested among indicators (CFA latent factors) to examine the feasibility of estimating a growth curve (see Table 3). Compared to composite measures as repeated indicators in a conventional latent growth curve model, using latent factors in a second-order latent growth curve model separated the variance of each indicator of higher-order growth factors into an item-specific and a time-specific variance component. The former component was conceptualized as the measurement error of the repeated indicators, while the latter component was captured by the latent factor. This approach allowed for autocorrelations among the indicators that considered the potential impact of conditions at one single time point on those at subsequent time points that reflected changes in the repeated indicators over time after taking measurement errors into account (Hancock et al., 2001).

The third step involved a longitudinal test of the average starting point/initial level on low self-control at the first wave ("intercepts") and individual growth/rate of change in low self-control across all the three waves ("slopes," see Table 4). For intercept, all paths from the latent factor to indicators were set to 1 across all measurement occasions, indicating there was no growth, but the latent factor was a constant. For the slope factor, factor loadings were fixed at 0, 1, and 2 (0, 2, and 3 for the early adolescence; 0, 1, and 3 for the late adolescence) corresponding to a linear growth model. Longitudinal measurement invariance was also specified, referred to as factorial invariance in which the mean parameters were freely estimated, but the factor loadings for the same indicators at different time points were constrained to be equal (strong invariance; see Appendix). This is so because it cannot be assumed that the second/higher-order growth curve captured the change in the "true" mean of the latent factor or the change was due to variability in the means of observed indicators. Therefore, any findings regarding change in low self-control would be invalid due to item bias or measurement artifacts if the assumption of longitudinal measurement invariance was not met (Meredith, 1964). Interindividual differences in the average starting point of low self-control were reflected in significant variance in the mean intercept, whereas interindividual differences in the average rate of change over time were represented in significant variance in the mean slope. Finally, after identifying an unconditional second-order latent growth curve model with measurement invariance,

[2] In the data set used for this study, there were two categories of parenting with four items per each category: (1) the opposite of neglect (i.e., positive parenting) and (2) abuse (i.e., negative parenting). We chose the four items, reflecting positive parenting instead of those to measure "abuse."

Table 2 Principal Component and Confirmatory Factory Analyses by Sample

Item #	Factor loading	PCA		CFA (standardized)		
		Eigenvalue	% of variance	Standardized coefficient	Reliability (α)	Model fit indices
Childhood (8, 9, and 10 years)						
Low self-control (LSC)						
LSC1w2	0.76			0.69**		
LSC2w2	0.68			0.57***		
LSC3w2	0.77	2.74	54.9	0.69***	0.79	
LSC4w2	0.70			0.60***		
LSC5w2	0.79			0.75***		
LSC1w3	0.75			0.70***		
LSC2w3	0.72			0.60***		CFI (0.93)
LSC3w3	0.76	2.80	56.0	0.67***	0.80	TLI (0.92)
LSC4w3	0.70			0.61***		RMSEA (0.05)
LSC5w3	0.81			0.76***		
LSC1w4	0.70			0.60***		
LSC2w4	0.61			0.48***		
LSC3w4	0.74	2.55	51.1	0.65***	0.75	
LSC4w4	0.73			0.64***		
LSC5w4	0.79			0.74***		
Parenting (PRT)						
PRT1w2	0.66	1.78	44.4	0.51***	0.54	
PRT2w2	0.59			0.46***		
PRT3w2	0.72			0.56***		
PRT4w2	0.69			0.51***		
Early Adolescence (12, 14, and 15 years)						
Low self-control (LSC)						
LSC1w3	0.73			0.65***		
LSC2w3	0.67			0.56***		
LSC3w3	0.79	2.74	54.8	0.73***	0.79	
LSC4w3	0.77			0.69***		
LSC5w3	0.73			0.66***		
LSC1w5	0.71			0.63***		
LSC2w5	0.64			0.50***		
LSC3w5	0.71	2.55	51.1	0.61***	0.76	CFI (0.94)
LSC4w5	0.73			0.64***		TLI (0.93)
LSC5w5	0.77			0.72***		RMSEA (0.04)
LSC1w6	0.75			0.67***		
LSC2w6	0.66			0.53***		
LSC3w6	0.73	2.71	54.1	0.64***	0.79	
LSC4w6	0.75			0.66***		
LSC5w6	0.79			0.75***		
Parenting						
PRT1w3	0.69	2.65	66.2	0.55***	0.81	
PRT2w3	0.84			0.77***		
PRT3w3	0.87			0.84***		
PRT4w3	0.84			0.80***		
Late adolescence (15, 16, and 18 years)						
Low self-control						CFI (0.90)
LSC1w3	0.75			0.67***		TLI (0.89)
LSC2w3	0.71			0.59***		RMSEA (0.05)

Table 2 (continued)

Item #	Factor loading	PCA		CFA (standardized)		
		Eigenvalue	% of variance	Standardized coefficient	Reliability (α)	Model fit indices
LSC3w3	0.73	2.69	53.9	0.63***	0.79	
LSC4w3	0.72			0.63***		
LSC5w3	0.76			0.72***		
LSC1w4	0.70			0.62***		
LSC2w4	0.65			0.52***		
LSC3w4	0.71	2.46	49.2	0.61***	0.74	
LSC4w4	0.67			0.57***		
LSC5w4	0.77			0.71***		
LSC1w6	0.71			0.62***		
LSC2w6	0.62			0.48***		
LSC3w6	0.66	2.34	46.8	0.54***	0.71	
LSC4w6	0.68			0.56***		
LSC5w6	0.75			0.69***		
Parenting (PRT)						
PRT1w3	0.61	2.41	60.2	0.44***		
PRT2w3	0.82			0.73***		
PRT3w3	0.84			0.80***		
PRT4w3	0.82			0.76***	0.76	

Note w = Wave of assessment. Standardized model results (*$p < .05$ **$p < .01$ ***$p < .001$) Rotation method: Varimax with Kaiser normalization. Rotation converged in 25 iterations

a time-invariant covariate (parenting) was added to explain change and its variance, referred to as the conditional model (see Table 5).

Results

First, a PCA was completed with orthogonal varimax rotation with Kaiser normalization and CFA to assess the internal measurement coherence of each latent factor of low self-control at the three measurement occasions and parenting at the first wave in each of the three different samples. Table 2 shows the PCA results with all factor loadings above 0.40 (cut-off criteria) to a single factor and eigenvalues above 1 (cut-off criteria) as well as CFA results with all coefficients to be statistically significant, reliability values all above 0.70 (except parenting among late children: 0.542), and model fit indices, CFI and TLI all above 0.90 (cut-off criteria; except low self-control among late adolescents: TLI = 0.885) as well as RMSEA all below 0.05 (cut-off criteria).

For model identification, the longitudinal covariance patterns of the latent year-to-year stability among lower/first-order latent factors of low self-control were investigated to examine the feasibility of estimating growth curves. Table 3 displays covariance matrix (i.e., zero-order cross-sectional, and longitudinal relationships) among the latent factors. The latent year-to-year covariances were 0.470 (Waves 2 and 3), 0.480 (Waves 3 and 4), and 0.396 (Waves 2 and 4) in the late children group; 0.366 (Waves 3 and 4), 0.524 (Waves 5 and 6), and 0.298 (Waves 3 and 6) in the early adolescent group; 0.480 (Waves 3 and 4), 0.443 (Waves 4 and 6), and 0.399 (Waves 3 and 6) with all covariances being significant ($p \leq 0.01$). Overall, parenting, family structure, and family SES correlated well with low self-control in the predicted (inverse) directions, while sex (male) was positively related to low self-control.

To assess the mean-level change in low self-control at three yearly assessments, and to test hypothesis 1, a second-order latent growth curve model was tested with strong measurement invariance for the three different age groups. The three second-order latent growth curve models achieved acceptable model fit (see Table 4). The mean estimates from second-order latent growth curve models were as follows: the low self-control trajectory decreased linearly across time by − 0.586 per year during childhood ($p \leq 0.001$); − 0.052 per year during early adolescence ($p \leq 0.01$); and − 0.102 per year among during late adolescence ($p \leq 0.001$), thus providing evidence of markedly smaller (5 to 10 times smaller) mean-level changes during the second decade of life in comparison to the first decade of life, during childhood. The significant variances in the mean intercept and mean slope indicated that interindividual differences in

Table 3 Correlations among the Main Study Variables by Sample

	1	2	3	4	5	6	7
Childhood (8, 9, and 10 years)							
1. Low self-control (8 years)	–	0.47**	0.40**	− 0.15**	0.01	− 0.02	− 0.06*
2. Low self-control (9 years)		–	0.48**	− 0.14**	0.07**	− 0.05*	− 0.12**
3. Low self-control (10 years)			–	− 0.15**	0.06*	− 0.02	− 0.04
4. Parenting				–	− 0.06**	0.10**	0.11**
5. Sex (male = 1)					–	− 0.04	− 0.03
6. Family structure						–	0.09**
7. Family SES							–
Early adolescence (12, 14, and 15 years)							
1. Low self-control (12 years)	–	0.37**	0.30**	− 0.20**	0.09**	-0.10**	− 0.14**
2. Low self-control (14 years)		–	0.52**	− 0.17**	0.01	-0.07**	− 0.13**
3. Low self-control (15 years)			–	− 0.17**	0.01	-0.07**	− 0.12**
4. Parenting				–	0.02	0.07**	0.13**
5. Sex (male = 1)					–	− 0.02	− 0.07*
6. Family structure						–	0.10**
7. Family SES							–
Late Adolescence (15, 16, and 18 years)							
1. Low self-control (15 years)	–	0.48**	0.40**	− 0.16**	0.07**	− 0.05*	− 0.12**
2. Low self-control (16 years)		–	0.44**	− 0.16**	0.06*	− 0.02	− 0.04
3. Low self-control (18 years)			–	− 0.16**	0.08**	− 0.02	− 0.05
4. Parenting				–	− 0.02	0.05*	0.06*
5. Sex (male = 1)					–	− 0.04	− 0.03
6. Family structure							0.09**
7. Family SES							–

Note *$p < .05$; **$p < .01$; ***$p < .001$

Table 4 Unstandardized mean and variance estimates of unconditional linear growth curve model of low self-control by study sample

	Intercept (initial level)		Linear slope		r (intercept & slope)	Model fit		
	Mean (M)	Variance	Mean (M)	Variance		CFI	TLI	RMSEA
Childhood 8, 9, and 10 years	0.00 (0.00)	**1.70*** ** (0.11)	**− 0.59*** ** (0.03)	**0.33*** ** (0.03)	**− 0.65*** ** (0.05)	0.94	0. 94	0.08
Early adolescence 12, 14, and 15 years	0.00 (0.00)	**0.52*** ** (0.05)	**− 0.05** ** (0.02)	**0.16*** ** (0.03)	− 0.05 (0.03)	0.96	0.96	0.06
Late adolescence 15, 16, and 18 years	0.00 (0.00)	**0.80*** ** (0.06)	**− 0.10*** ** (0.02)	**0.15*** ** (0.02)	**− 0.15*** ** (0.03)	0.94	0.94	0.07

The intercept was fixed at 0 as the default to set the metric of the factor

Note Boldface entries are unstandardized coefficients and reflect statistically significant coefficients (*$p < .05$; **$p < .01$; ***$p < .001$)

Standard errors are reported in parentheses

Table 5 Unstandardized estimates of parenting and correlates on conditional latent growth curves of low self-control by study sample

Variables	Sample 1				Sample 2				Sample 3			
	Childhood (8, 9, and 10 years)				Early adolescence (12, 14, and 15 years)				Late adolescence (15, 16, and 18 years)			
	Intercept		Slope		Intercept		Slope		Intercept		Slope	
	b	*S.E*	*b*	*S.E*	*B*	*S.E*	*b*	*S.E*	*b*	*S.E*	*b*	*S.E*
Sex (male = 1)	**0.49*** **	0.08	− 0.01	0.05	**0.26*** **	0.06	**− 0.13*** **	0.04	0.02	0.06	0.06	0.04
Family structure	− 0.78	0.68	− 0.18	0.11	− 0.11	0.31	0.02	0.12	− 0.39	0.33	0.20	0.21
Family SES	**− 0.05*** **	0.01	**0.02***	0.01	**− 0.04*** **	0.01	0.01	0.01	**− 0.03*** **	0.01	0.01	0.01
Parenting	**− -0.35***	0.17	− 0.13	0.10	**− 0.40*** **	0.07	− 0.04	0.05	**− 0.36*** **	0.10	-0.07	0.05
Intercept	0.00	0.00	**− 0.38****	0.14	0.00	0.00	− 0.06	0.13	0.00	0.00	-0.33	0.21
Residual variance	**1.52*** **	0.15	**0.32*** **	0.05	**0.46*** **	0.06	**0.16*** **	0.04	**0.71*** **	0.08	**0.12*** **	0.03
Model fit indices												
CFI	0.98				0.97				0.95			
TLI	0.98				0.97				0.94			
RMSEA	0.03				0.04				0.05			

Family structure (two parents = 1)

Note Boldface entries are standardized coefficients and reflect statistically significant coefficients (*$p < .05$; **$p < .01$; ***$p < .001$)

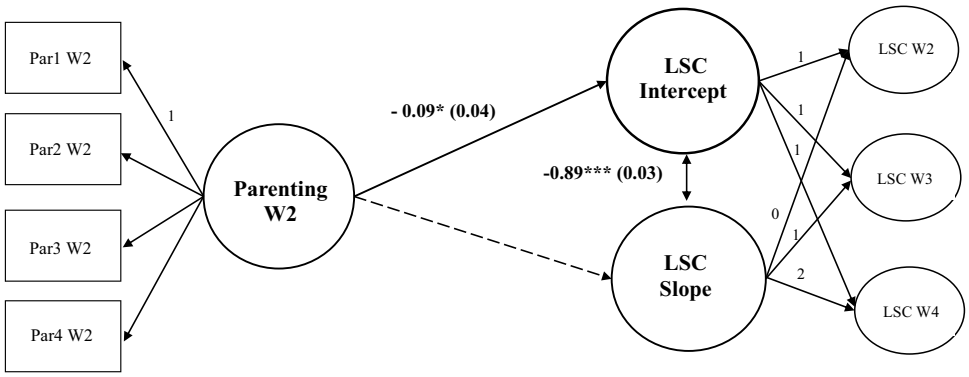

Fig. 1 Standardized Estimates of Parenting and Correlates on Conditional Latent Growth Curves of Low Self-control during Childhood (ages 8, 9, and 10). *Note. W Wave, Par* Parenting, *LSC* low self-control. Waves 2, 3, and 4 of the elementary school panel are ages 8, 9, and 10 years. Paths from the slope to the observed scores were fixed to values reflecting the time intervals between each assessment. Boldface entries are standardized coefficients and statistically significant (*$p < .05$; ** $< .01$; ***$p < .001$)

the initial level and rate of change in low self-control significantly varied over time, reflecting sample heterogeneity ($Var_{Intercept} = 1.699$ and $Var_{slope} = 0.325$ during childhood; $Var_{Intercept} = 0.517$ and $Var_{slope} = 0.160$ during early adolescence; $Var_{Intercept} = 0.798$ and $Var_{slope} = 0.151$ during late adolescence at $p \leq 0.001$, respectively). The initial level significantly and inversely covaried with the rate of change (Cov = − 0.650 for the childhood sample; Cov = − 0.150 for the late adolescent group at $p \leq 0.001$, respectively). This indicated that individuals with less self-control demonstrated a gradually decreasing rate of change over time.

Addressing hypotheses 2 and 3, the last set of analyses tested the predictive relationships between parenting and developmental trajectories in low self-control across the three different developmental periods (childhood, early adolescent, and late adolescence). Table 4 displays the unstandardized estimates of the relationships, while Figs. 1, 2, and 3 include standardized estimates. Regarding control variables, sex (male) was significantly and positively associated with the initial level for *only* during childhood ($b = 0.485$) and early adolescence ($b = 0.258$) groups (at $p \leq 0.001$), but was significantly and inversely related to the rate of change *only* during early adolescence ($b = -0.133$ at $p < 0.001$). Family SES was significantly and inversely related to the initial level across all three age groups ($b = -0.054$; $b = -0.04$; $b = -0.028$ at $p < 0.001$, respectively).

In summary, across all three samples and age groups, significant individual differences were found, not only in the initial level, but also in the rate of change of low self-control

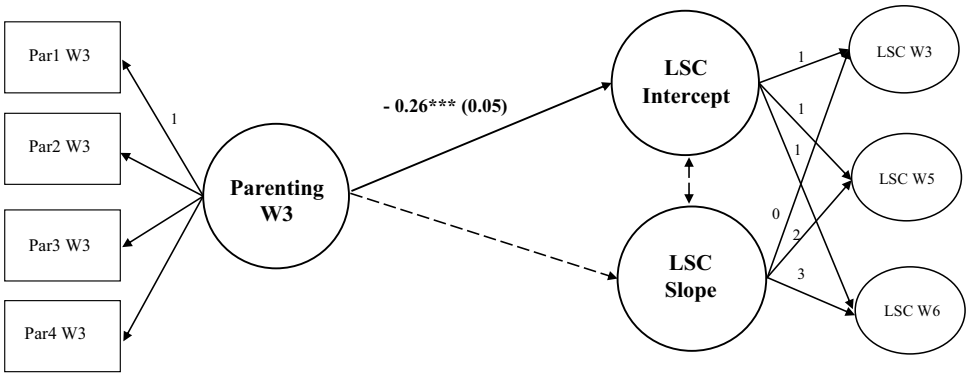

Fig. 2 Standardized Estimates of Parenting and Correlates on Conditional Latent Growth Curves of Low Self-control during Early Adolescence (ages 12, 14, and 15). *Note. W* Wave, *Par* Parenting, *LSC* low self-control. Waves 3, 5, and 6 of the fourth-grade elementary are ages 12, 14, and 15 years. Paths from the slope to the observed scores were fixed to values reflecting the time intervals between each assessment. Boldface entries are standardized coefficients and statistically significant (*$p < .05$; **$p < .01$; ***$p < .001$), non-significant paths are omitted

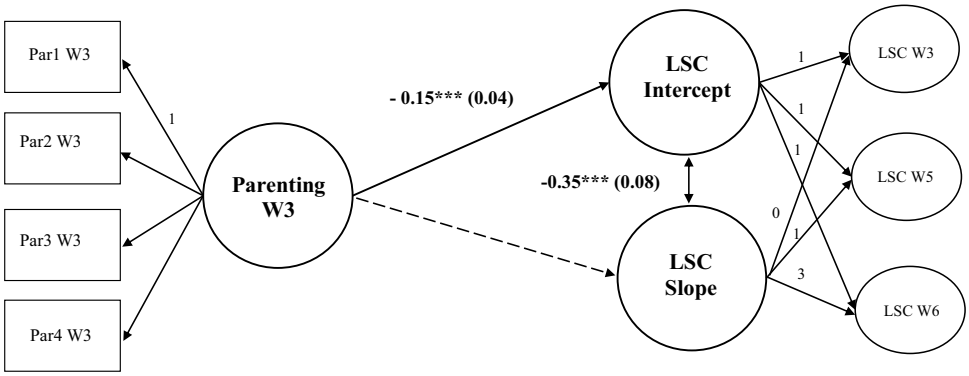

Fig. 3 Standardized Estimates of Parenting on Conditional Latent Growth Curves of Low Self-control during Late Adolescence (ages 15, 16, and 18). *Note. W* Wave, *Par* Parenting, *LSC* low self-control. Waves 3, 4, and 6 of the high school panel are ages 15, 16, and 18 years. Paths from the slope to the observed scores were fixed to values reflecting the time intervals between each assessment. Boldface entries are standardized coefficients and statistically significant (*$p < .05$; **$p < .01$; ***$p < .001$)

(a decreasing pattern of development) over time; however, parenting was only significantly related to initial levels, not the rate of change of low self-control over time. The results from each predictive model revealed that parenting was significantly and inversely related to the initial level of low self-control across all three age groups ($b = -0.354$ at $p \leq 0.05$ for the late childhood group; $b = -0.4$ at $p \leq 0.001$ for the early adolescent group; $b = -0.355$ at $p \leq 0.001$ for the late adolescent group). Individuals who experienced poor parenting tended to have lower levels of self-control in comparison to those who did not. However, parenting was not significantly related to the rate of change in low self-control in any of the three developmental periods. The addition of parenting to the full model reduced the unexplained variance of the intercept of low self-control by 12.1% (1.699–1.516/1.516) for the childhood sample, 12.8% (0.517–0.458/0.458) for the early adolescent sample, and 12.7% (0.798–0.708/ 0.708) for the late adolescent sample, providing evidence of largely consistent magnitudes of effect across the first and second decades of life. In conclusion, this indicated that parenting was an important predictor for the initial level of low self-control, but not for the rate of change over time.

Discussion

The current investigation sought to contribute to the literature focused on testing level or within individual changes in self-control over time and the importance of positive parenting on the development of self-control, particularly during the first and second decades of life. In addition, it expanded upon previous research by investigating this question on samples of South Korea and youth as the bulk of previous research has focused on North American samples. Based on self-control theory and the age–crime relationship, as well as based on neuroimaging evidence about age-graded changes

over time (Casey et al., 2011; Vazsonyi & Ksinan, 2017), it was expected that self-control would continue to change (within individual changes or level changes) during both the first and second decades of life, though to a lesser extent during adolescence in comparison to childhood. The evidence supported this, with substantially larger changes during childhood in comparison to changes during adolescence. It was also expected that positive parenting efforts would predict both the initial status as well as the rate of change over time in self-control during childhood, and that it would only predict the initial status in self-control during both early and late adolescence. Parenting longitudinally predicted the initial status of self-control across all three samples, the childhood sample, the early adolescent sample, and the late adolescent sample, and it did so remarkedly consistently. In fact, the addition of parenting to the model reduced the total amount of unexplained variance by approximately 12% to 13%, across all three samples. However, contrary to expectations, positive parenting did not predict the rate of change during childhood.

This finding was unexpected based on theory, however, not entirely unexpected based on previous research. Vazsonyi and Huang (2010) made the same finding based on a sample of over 1000 children from the United States using a similar latent growth modeling technique. On the other hand, Vazsonyi and Javakhishvili (2019) found that parenting effects when assessed during infancy predicted some developmental changes in self-control not only during childhood, but also during adolescence. Specifically, parental sensitivity and parental attachment assessed during the first three years of life predicted developmental changes in self-control at age 8.5 years, while parental sensitivity predicted developmental changes of self-control at age 15; and finally, the HOME measure also assessed early during the first year of a child's life predicted developmental changes in self-control at age 11.5 years.

Thus, study findings might implicate that although positive parenting assessed during childhood, early adolescence, and late adolescence in the current samples did not explain variance in self-control development (between individual changes) over time during childhood, early adolescence, and late adolescence. However, in other research, positive parenting indicators assessed during the first three years of life during infancy using different methods of assessment, including observational methods, provided such evidence (Vazsonyi & Javakhishvili, 2019). These latter findings both reduce threats to causal inference, something Gottfredson and Hirschi (2020) identify as one of the next important frontiers of research, and term "a central focus for criminology" (p. 215); they also identify another important frontier, "research needs," a focus on infancy or early childhood, "Among the most pressing are indicator studies for measurement of both self control and early child environments" (p. 215).

Gottfredson and Hirschi (1990) did not differentiate, describe, or discuss potential differences in positive parenting or socialization effects during different periods of the first decade of life very explicitly; this evidence certainly does not signal that the evidence does not support theoretical predictions made, but simply perhaps that there might be greater nuances to the timing of when positive parenting effects impact the developmental course of or developmental changes in low self-control over time. In fact, they noted that.

> differences in impulsivity and insensitivity become noticeable later in childhood when they are no longer common to all children. The ability and willingness to delay immediate gratification for some larger purpose may therefore be assumed to be a consequence of training. Much parental action is in fact geared toward suppression of impulsive behavior, toward making the child consider the long-term consequences of acts. Consistent sensitivity to the needs and feelings of others may also be assumed to be a consequence of training. Indeed, much parental behavior is directed toward teaching the child about the rights and feelings of others, and of how these rights and feelings ought to constrain the child's behavior. All of these points focus our attention on child-rearing (pp. 96–97).

The importance of this statement lies in the fact that they identify how these characteristics and behaviors become noticeable *later in childhood* (emphasis added). One could argue that the implication of this is that training efforts by parents or caregivers prior to late childhood seem critical in differentiating among children who learn to constrain impulsivity or impulsive behaviors as well as insensitivity or insensitive acts versus ones who do not. In fact, if noticeable later in childhood, the implication is that differences in training are antecedent to this, leading to *early childhood or infancy*. Thus, whether explicit or not, Gottfredson and Hirschi (1990) clearly identified what could be termed as "the first half of the first decade of life" as being highly salient and even critical in producing variability in low self-control, in addition to what they called "the degree to which they manifest such traits to begin with" (p. 96), that is, individual differences that are largely present at birth. Furthermore, Gottfredson and Hirschi (2020) explicitly describe and use the term of "attachments formed early in life between parents or other caregivers and their children" (p. 5), something Bowlby (1946) identified as missing among the 44 delinquents he studied as "Affectionless Character… (with) a history of early mother–child separation" (p. 52), particularly salient if it occurred during the first *5 years* of life. A number of delinquents who had not suffered such a

separation "had mothers who were either extremely anxious, irritable, and fussy or else rigid, domineering and oppressive, traits which in all cases mask unconscious hostility" (p. 55). Gottfredson and Hirschi (1990, 2020) never particularly allude to Bowlby's work, although Hirschi did (2002), and noted, based on Nye, entirely consistent with this work, "if the child is alienated from the parent, he will not learn or will have no feeling for moral rules, he will not develop an adequate conscious or superego" (p. 86).

The importance of these connections with previous research and writings is that Gottfredson and Hirschi identified the first decade of life, perhaps the early part of it based on recent insights (Gottfredson & Hirschi, 2020; see Vazsonyi & Javakhishvili, 2019 for evidence supporting this) as well as longstanding insights (first 5 years of life, Bowlby, 1946) is key to understanding variability in self-control, as well as presumably variability in developmental changes over time. The fact that they described how differences between children were evident in later childhood again implies that some of the causes that might produce these differences must be antecedent, namely during infancy and early childhood, during the first five years of life. Gottfredson and Hirschi (2020) note that.

> Attachment to family naturally generalizes to concern about the consequences of one's behaviors for others in social systems that formally express disapprobation for acts that cause harm to others -- whether it is classroom disruption, theft, bullying or violence, inadequate attention to health needs, substance use and so on. Self-control is created in significant ways by attention to concerns of others, and once created, it guides behaviors that can be harmful or beneficial to self throughout life (p. 227).

Strongly supporting this idea, and also clearly evident in the current study by how much parenting was consistently associated with initial levels of self-control across the three samples, located in three developmental periods, how consistently it explained variance in self-control, consider the following, commenting not so much on absolute levels, but rank order differences, or in effect, vis-à-vis others:

> We say instead that *once established*, differences between individuals *tend* to remain stable over the life course. We also say that *once established*, high levels of self-control do not appear to dissipate much with age (Gottfredson & Hirschi, 2020, p. 79).

One potential competing explanation, if one does not consider what Gottfredson and Hirschi wrote, nor if one considers study findings by Vazsonyi and Javakhishvili (2019), is that it is not training or positive parenting efforts during the first half of the first decade of life, but in fact mostly heritable individual differences that underlie and largely explain developmental changes in self-control over time. In other words, it is conceivable that heritable materials not only influence the initial status of low self-control but also impact the developmental course of how self-control unfolds over time. At present, there does not exist much empirical evidence that could directly answer this question, but it is clear that heritable materials play a substantial role in individual differences of low self-control (Willems et al., 2018) and also potentially in how self-control develops during the first and second decades of life. In addition, Li et al. (2019) note evidence supporting bidirectional effects between parenting and self-control during adolescence, thus also pointing to the potential importance of individual differences, in both parenting and self-control (see also Vazsonyi et al., 2015 for evidence supporting bidirectional effects).

Limitations

The current investigation is not without a number of limitations, including (1) how positive parenting was assessed by a very modest number of items and based on self-report methodology, thus potentially introducing model method and measurement biases; (2) that parenting was measured only as what amounts to interest and closeness which means that no measures of recognizing deviant behavior or of punishing deviant behavior were included, known theoretically to be key in understanding the variability in self-control and variability in the development of self-control; (3) that no competing or alternative explanatory constructs were included in the model such as peer effects, measures of routine activities, or other measures of individual differences; and (4) whether aggregate-level characteristics of school and neighborhood influence self-control development.

Conclusion

The current investigation makes important contributions to the literature by testing within individual or level changes in self-control during childhood and adolescence; the evidence supports these changes, with markedly larger ones during childhood (5 to 10 times larger) than during adolescence. It also contributes to the literature by testing the extent to which positive parenting during childhood, during early adolescence, and late adolescence consistently influences self-control, during childhood, during the early adolescence, and during late adolescence (same magnitude of effect). Importantly, it does so based on data collected in South Korea, thus addressing a key theoretical tenet by self-control theory, namely that predictions by the theory have applicability across ethnic and racial groups, but also across

cultural and national boundaries. The evidence is clear; positive parenting measured during childhood, during early adolescence, and during late adolescence is associated with the initial status of self-control during childhood, during early adolescence, and during late adolescence. However, and contrary to expectations, positive parenting was unrelated to developmental changes over time during childhood or later. Despite being contrary to expectations, this finding is consistent with some previous research, thus potentially implicating an earlier critical period of positive socialization pressures, likely located during infancy or very early childhood, during the first five years of life, and likely a function of how parenting or parenting environments are assessed, through direct observations or observed ratings (Vazsonyi & Javakhishvili, 2019). The present study findings also leave open the possibility that individual differences that are present to begin with in a child's life might not only account for the level at which a child commences the development of self-control but also the rate at which potential developmental changes take place over time. This is an important empirical question, one that will likely be addressed in more narrowly focused future research.

Appendix

M*plus* Syntax to Test Strong Measurement Invariance for a Second/Higher-Order Growth Curve Model.

```
USEVARIABLES are.
LSC1w2 LSC2w2 LSC3w2 LSC4w2 LSC5w2.
LSC1w3 LSC2w3 LSC3w3 LSC4w3 LSC5w3.
LSC1w4 LSC2w4 LSC3w4 LSC4w4 LSC5w4;
Categorical are.
LSC1w2 LSC2w2 LSC3w2 LSC4w2 LSC5w2.
LSC1w3 LSC2w3 LSC3w3 LSC4w3 LSC5w3.
LSC1w4 LSC2w4 LSC3w4 LSC4w4 LSC5w4;
Analysis:
PARAMETERIAZATION = THETA;
Model:
LSCw2 by LSC1w2 LSC2w2 LSC3w2 LSC4w2 LSC5w2 (1–4);
LSCw3 by LSC1w3 LSC2w3 LSC3w3 LSC4w3 LSC5w3 (1–4);
LSCw4 by LSC1w4 LSC2w4 LSC3w4 LSC4w4 LSC5w4 (1–4);
LSC1w2$1 LSC1w3$1 LSC1w4$1 (5);
LSC2w2$1 LSC2w3$1 LSC2w4$1 (6);
LSC3w2$1 LSC3w3$1 LSC3w4$1 (7);
LSC4w2$1 LSC4w3$1 LSC4w4$1 (8);
LSC5w2$1 LSC5w3$1 LSC5w4$1 (9);
S1| LSCW2@0 LSCW3@1 LSCW4@2;
```

Author contributions AV: conceptualization, methodology, writing, interpretation, visualization. SC: data analysis, interpretation, visualization, reviewing, and editing.

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Data availability For more information about the panel data, please contact the National Youth Policy Institute (NYPI): http://archive.nypi.re.kr/

Declarations

Conflict of interest The authors certify that they have no affiliations with or involvement in any organization or entity with any financial interest or non-financial interest in the subject matter or materials discussed in this manuscript.

Ethical Approval The Korean Children and Youth Panel Survey (KCYPS) followed standard ethical procedures in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments which included active parental consent for child participation.

References

Arneklev, B. J., Cochran, J. K., & Gainey, R. R. (1998). Testing Gottfredson and Hirschi's '"low self-control"' stability hypothesis: An exploratory study. *American Journal of Criminal Justice, 23*(1), 107–127.

Beaver, K. M., Connolly, E. J., Schwartz, J. A., Al-Ghamdi, M. S., & Kobeisy, A. N. (2013). Genetic and environmental contributions to stability and change in levels of self-control. *Journal of Criminal Justice, 41*(5), 300–308. https://doi.org/10.1016/j.jcrimjus.2013.07.003

Beaver, K. M., & Wright, J. P. (2007). The stability of low self-control from kindergarten through first grade. *Journal of Crime and Justice, 30*(1), 63–86. https://doi.org/10.1080/0735648X.2007.9721227

Boisvert, D., Wright, J. P., Knopik, V., & Vaske, J. (2012). Genetic and environmental overlap between low self-control and delinquency. *Journal of Quantitative Criminology, 28*, 477–507. https://doi.org/10.1007/s10940-011-9150-x

Boutwell, B. B., & Beaver, K. M. (2010). The intergenerational transmission of low self-control. *Journal of Research in Crime and Delinquency, 47*(2), 174–209. https://doi.org/10.1177/0022427809357715

Bowlby, J. (1946). *Forty-four juvenile thieves: Their characters and home-life*. Bailliere, Tindall, & Cox.

Burt, C. H., Simons, R. L., & Simons, L. G. (2006). A longitudinal test of the effects of parenting and the stability of self-control: Negative evidence for the general theory of crime. *Criminology, 44*(2), 353–396. https://doi.org/10.1111/j.1745-9125.2006.00052.x

Burt, C. H., Simons, R. L., & Simons, L. G. (2014). Self-control through emerging adulthood: Instability, multidimensionality, and criminological significance. *Criminology, 52*(3), 450–487. https://doi.org/10.1111/1745-9125.12045

Byrne, B. M. (2012). *Multivariate applications series. Structural equation modeling with Mplus: Basic concepts, applications, and programming*. Taylor & Francis Group.

Casey, B. J., Jones, R. M., & Somerville, L. H. (2011). Braking and accelerating of the adolescent brain. *Journal of Research on Adolescence, 21*, 21–33. https://doi.org/10.1111/j.1532-7795.2010.00712.x

Coyne, M. A., Vaske, J. C., Boisvert, D. L., & Wright, J. P. (2015). Sex differences in the stability of self-regulation across childhood. *Journal of Developmental and Life-Course Criminology, 1*, 4–20. https://doi.org/10.1007/s40865-015-0001-6

Coyne, M. A., & Wright, J. P. (2014). The stability of self-control across childhood. *Personality and Individual Differences, 69*, 144–149. https://doi.org/10.1016/j.paid.2014.05.026

Diamond, B. (2016). Assessing the determinants and stability of self-control into adulthood. *Criminal Justice and Behavior, 43*(7), 951–968. https://doi.org/10.1177/0093854815626950

Diamond, B., Morris, R. G., & Piquero, A. R. (2015). Stability in the underlying constructs of self-control. *Crime and Delinquency, 63*(3), 235–266. https://doi.org/10.1177/0011128715603721

Forrest, W., Hay, C., Widdowson, A. O., & Rocque, M. (2019). Development of impulsivity and risk-seeking: Implications for the dimensionality and stability of self-control. *Criminology, 57*(3), 512–543. https://doi.org/10.1111/1745-9125.12214

Gottfredson, M. R. (2021). The essential role of cross-national research in assessing theories of crime: Illustrations from modern control theory. *International Journal of Criminology*. https://doi.org/10.1007/s43576-020-00003-w

Gottfredson, M. R., & Hirschi, T. (1990). *A general theory of crime*. Stanford University Press.

Gottfredson, M. R., & Hirschi, T. (2020). *Modern control theory and the limits of the criminal sanction*. Oxford University Press.

Hancock, G. R., Kuo, W. L., & Lawrence, F. R. (2001). An illustration of second-order latent growth models. *Structural Equation Modeling, 8*(3), 470–489.

Hay, C., & Forrest, W. (2006). The development of self-control: Examining self-control's stability thesis. *Criminology, 44*(4), 739–774. https://doi.org/10.1111/j.1745-9125.2006.00062.x

Hirschi, T. (2002). *Causes of delinquency*. Transaction Publishers.

Hirschi, T., & Gottfredson, M. (1983). Age and the explanation of crime. *American Journal of Sociology, 89*(3), 552–584. https://doi.org/10.1086/227905

Jo, Y. (2015). Stability of self-control: Hirschi's redefined self-control. *International Journal of Offender Therapy and Comparative Criminology, 59*(1), 51–67. https://doi.org/10.1177/0306624X13501839

Li, J. B., Willems, Y. E., Stok, F. M., Dekovi, M., Bartels, M., & Finkenauer, C. (2019). Parenting and self-control across early to late adolescence: a three-level meta-analysis. *Perspectives on Psychological Science, 14*(6), 967–1005. https://doi.org/10.1177/1745691619863046

McArdle, J. J. (1988). Dynamic but structural equation modeling of repeated measures data. In J. R. Nesselroade & R. B. Cattell (Eds.), *Handbook of multivariate experimental psychology* (pp. 561–614). Plenum Press.

McKnight, P. E., McKnight, K. M., Sidani, S., & Figueredo, A. J. (2007). *Missing data: A gentle introduction*. Guilford Press.

Meinert, J., & Reinecke, J. (2018). Self-control during adolescence: Examining the stability of low self-control and the effects of parental social controls. *European Journal of Criminology, 15*(5), 523–543. https://doi.org/10.1177/1477370817749180

Meldrum, R. C., & Hay, C. (2012). Do peers matter in the development of self-control? Evidence from a longitudinal study of youth. *Journal of Youth and Adolescence, 41*(6), 691–703. https://doi.org/10.1007/s10964-011-9692-0

Meredith, W. (1964). Notes on factorial invariance. *Psychometrika, 29*(2), 177–185. https://doi.org/10.1007/BF02289699

Mitchell, O., & MacKenzie, D. L. (2006). The stability and resiliency of self-control in a sample of incarcerated offenders. *Crime and Delinquency, 52*(3), 432–449. https://doi.org/10.1177/0011128705280586

Moffitt, T. E., Arseneault, L., Belsky, D., Dickson, N., Hancox, R. J., Harrington, H., ... & Caspi, A. (2011). A gradient of childhood self-control predicts health, wealth, and public safety. *Proceedings of the National Academy of Sciences*, *108*(7), 2693–2698. https://doi.org/10.1073/pnas.1010076108

Muthen, L. K., & Muthen, B. O. (2015). *Mplus user's guide* (7th ed.). Muthén & Muthén.

Na, C., & Paternoster, R. (2012). Can self-control change substantially over time? Rethinking the relationship between self- and social control. *Criminology, 50*(2), 427–462. https://doi.org/10.1111/j.1745-9125.2011.00269.x

Nofziger, S. (2008). The "cause" of low self-control: The influence of maternal self-control. *Journal of Research in Crime and Delinquency, 45*(2), 191–224. https://doi.org/10.1177/0022427807313708

Nofziger, S., & Johnson, T. (2020). Revisiting the concept of stability in the general theory of crime. *Crime & Delinquency, 66*(6–7), 739–769. https://doi.org/10.1177/0011128719890264

Nofziger, S., & Newton, K. (2018). Self-control, parental crime, and discipline across three generations. *Deviant Behavior, 39*(12), 1533–1551. https://doi.org/10.1080/01639625.2017.1410616

Piquero, A. R., Jennings, W. G., & Farrington, D. P. (2010). On the malleability of self-control: Theoretical and policy implications regarding a general theory of crime. *Justice Quarterly, 27*, 803–834.

Ray, J. V., Jones, S., Loughran, T. A., & Jennings, W. G. (2013). Testing the stability of self-control: Identifying unique developmental patterns and associated risk factors. *Criminal Justice and Behavior, 40*(6), 588–607. https://doi.org/10.1177/0093854812464222

Skardhamar, T. (2010). Distinguishing facts and artifacts in group-based modeling. *Criminology, 48*(1), 295–320. https://doi.org/10.1111/j.1745-9125.2010.00185.x

Tittle, C. R., Ward, D. A., & Grasmick, H. G. (2003). Self-control and crime/deviance: Cognitive vs behavioral measures. *Journal of Quantitative Criminology, 19*(4), 333–365.

Turner, M. G., & Piquero, A. R. (2002). The stability of self-control. *Journal of Criminal Justice, 30*(6), 457–471. https://doi.org/10.1016/S0047-2352(02)00169-1

Vazsonyi, A. T., & Huang, L. (2010). Where self-control comes from: On the development of self-control and its relationship to deviance over time. *Developmental Psychology, 46*(1), 245–257. https://doi.org/10.1037/a0016538

Vazsonyi, A.T, & Javakhishvili, M. (2019). Infant socialization and the development of self-control: Filling in the gap (pp. 239–256). In J. Oleson & B.J. Costello (Eds.), Advances in Criminological Theory (Volume 25), *Fifty Years of Causes of Delinquency: The Criminology of Travis Hirschi* (1st edn). Routledge

Vazsonyi, A. T., & Jiskrova, G. K. (2018). On the development of self-control and deviance from preschool to middle adolescence. *Journal of Criminal Justice, 56*, 60–69. https://doi.org/10.1016/j.jcrimjus.2017.08.005

Vazsonyi, A. T., & Ksinan, A. J. (2017). Understanding deviance through the dual systems model: Converging evidence for criminology and developmental sciences. *Personality and Individual Differences, 111*, 58–64. https://doi.org/10.1016/j.paid.2017.01.030

Vazsonyi, A. T., Roberts, J., & Huang, L. (2015). Why focusing on nurture made and still makes sense: The biosocial development of self-control. In M. J. DeLisi & M. G. Vaughn (Eds.), *Routledge*

international handbook of biosocial criminology (pp. 263–280). Taylor & Francis Group.

Willems, Y. E., Dolan, C. V., van Beijsterveldt, C., de Zeeuw, E. L., Boomsma, D. I., Bartels, M., & Finkenauer, C. (2018). Genetic and environmental influences on self-control assessing self-control with the ASEBA self-control scale. *Behavior Genetics, 48*(2), 135–146. https://doi.org/10.1007/s10519-018-9887-1

Winfree, L. T., Jr., Taylor, T. J., He, N., & Esbensen, F. A. (2006). Self-control and variability over time: Multivariate results using a 5-year, multisite panel of youths. *Crime and Delinquency, 52*(2), 253–286. https://doi.org/10.1177/0011128705278012

Wright, J. P., & Beaver, K. M. (2005). Do parents matter in creating self-control in their children? A genetically informed test of Gottfredson and Hirschi's theory of low self-control. *Criminology, 43*(4), 1169–1202. https://doi.org/10.1111/j.1745-9125.2005.00036.x

Yun, I., & Walsh, A. (2011). The stability of self-control among South Korean adolescents. *International Journal of Offender Therapy and Comparative Criminology, 55*(3), 445–459. https://doi.org/10.1177/0306624X09358072