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Longitudinal associations between parenting practices and children's later decision-making competence

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ABSTRACT

Developmental research has suggested that certain parenting practices impact the development of children's later risk behaviors. However, little evidence exists regarding how parenting may impact a child's actual decision-making skills later in life. This study examined the degree to which earlier child-reports of parenting practices (assessed at age 10–12 and 12–14), specifically monitoring/involvement, firm/lax control, and psychological control, predicted decision-making competence (*DMC*), a measure of decision-making skills, at age 19. We conducted these analyses on a large, diverse sample of children ($N = 775$; 227 Female, 21.8% African-American); approximately half had at least one parent with a positive Substance Use Disorder (SUD) diagnosis. Analyses revealed that children reporting greater levels of psychological control demonstrated lower DMC performance at age 19, holding other parenting variables, level of neighborhood disadvantage, and parental SUD status constant. We relate these results to the broader effects of psychological control on decision-making and self-regulatory capabilities.

The period between early adolescence and emerging adulthood is typically a time when individuals get the opportunity to make substantially more consequential decisions, including driving without restrictions, gaining the legal ability to vote in national elections, choosing whether and where to attend college, deciding career paths, and starting a family. This developmental period also is associated with an increase in problem behaviors, such as delinquency, substance use, and health-risking sexual behaviors, which may indicate the start of a problematic lifelong trajectory (Arnett, 1992, 2015). It is often argued that problematic risk-taking is suggestive of suboptimal decision-making tendencies (Dahl, 2004; Kwan et al., 2012; Romer et al., 2017; Steinberg, 2008; Warren et al., 1997). Furthermore, considerable individual differences in normative decision-making skills exist during this time, as children and adolescents develop more cognitive sophistication, which may contribute to problem behavior engagement (Parker & Fischhoff, 2005; Toplak et al., 2014; Toplak & Flora, 2021; Weller et al., 2012).

One potential source of this heterogeneity may arise from parent-child interactions. Developmental research has suggested that a host of parenting behaviors, such as low parental monitoring/involvement (i.e., knowing a child's whereabouts, his/her friends, etc.), inconsistent discipline, and psychological control (i.e., parental attempts to indirectly control a child's behaviours through manipulative techniques, like instilling guilt and anxiety), may impact the development of risk behaviors later in life (Arnett, 2015; Barber et al. 2005; Pinquart, 2017). Although these studies suggest that these parenting practices influence the choices that children and adolescents make, a dearth of research exists that examines the degree to which parenting practices are associated with suboptimal decision-making skills themselves. Instead, most research has focused on risky problem behaviors (e.g., substance use, delinquency, etc.) as being indicative of poor decision quality, rather than examining the association between parenting and how their children make decisions. To address this question, the current study leveraged a long-term longitudinal study to test the degree to which parental acceptance/rejection, monitoring/involvement, psychological control, and firm vs. lax behavioral control during pre- and early adolescence (age 10–12 and again at

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14 years) are associated with performance on an objective measure of decision-making, assessed at approximately age 19.

Associations between parenting practices and children's decision-making behavior

Numerous influential theoretical models have proposed that negative parenting practices, including, but not limited to, psychological control and harsh and/or inconsistent discipline (O'Connor, 2002), adversely impacts a child's social development and engagement in risk behaviors later in life (Arnett, 2015; Baumrind, 1967; Gottfredson & Hirschi, 1990; Jessor, 1987). Meta-analytic research (Li et al., 2019) suggests that such practices are robustly associated with lower reported self-regulative tendencies, and invariant with respect to culture and the sex of both the parent and the child (Brody & Ge, 2001; Cheung & Cheung, 2010; Feldman & Wentzel, 1990; Hallquist et al. 2015; Li et al., 2019; Simons et al., 2007; Zhai et al., 2014). Similarly, such practices also have been linked to the development of executive functioning, which enables goal-oriented responses, planning, inhibitory control, emotion regulation, and responses in ambiguous situations (Fay-Stammbach et al. 2014; Gottfredson & Hirschi, 1990), Importantly, these functions support cognitive skills such as decision making, academic achievement, and prosocial behavior (Parker et al., 2018; Pinquart, 2017; Romer et al., 2017; Weller et al., 2015).

Parental monitoring/involvement

One specific set of parenting behaviors that has garnered considerable attention is the degree to which parents monitor, and are involved with, the lives of their children. Parental monitoring/involvement is typically defined by behaviors such as knowing their child's whereabouts, their friends, and the activities that interest the child. Lower reported parental monitoring/involvement has been associated with a range of risk behaviors in adolescents, including, antisociality, deviant peer association, substance use, and health-risking sexual behavior (Barnes et al., 2006; Bogenschneider et al., 1998; Borawski et al., 2003; Brown et al., 1993; Commendador, 2010; Cutrín et al., 2019, 2022; Hoeve et al., 2009; Kerr et al., 2010; S. Miller et al., 2008; Parkes, et al., 2011; Roche et al. 2005). Parental monitoring/involvement has been shown to be associated with increased parent-child cohesion, and communication, which is believed to help transmit values to children that may steer them away from problematic risk behaviors (e.g., Ceballo et al., 2003; Garbarino, 1999).

Parental control behaviours

Another aspect of parenting practices relates to controlling a child's behavior. One way of achieving this goal is by utilizing proactive and *direct* actions, such as firm rule setting and consistent enforcement of rules (Grolnick et al., 1997). These practices, which we refer to as *firm control,* are believed to introduce and maintain structure in a child's environment, by establishing clear and consistent rules for behavior. Such structure not only provides a predictable environment for a child but also direct feedback about decisions and actions that the child makes (Grolnick & Pomerantz, 2009). Children who perceive a greater degree of firm structure, and a consistent absence of harsh or coercive control behaviors, tend to show greater levels of self-control, achievement-motivations, and academic performance (Li et al., 2019; Rodríguez-Meirinhos et al., 2020; Wilder, 2014).

Psychological control. Direct, proactive behavioral control practices can be contrasted against indirect behavioral control parenting practices that aim to internally control the child, often referred to as *psychological control* (Barber, 1996). Providing structure *via* rulemaking and enforcement needs to be considered separate from coercive and overbearing attempts to control a child's behavior, the latter which can hinder a child's psychosocial development (Soenens & Vansteenkiste, 2010). A psychologically controlling parent will attempt to regulate child behaviors employing parental behaviors such as withdrawing love when a child has broken a rule, shaming a child for his/her actions, and instilling guilt or anxiety. Soenens and Vansteenkiste (2010) highlight that whereas parental monitoring/involvement may promote competence and achievement goals, whereas psychological controlling parenting may hinder a child's goal development (Barber, 1996; Lau et al., 2016). In addition, these manipulative, indirect control tactics are believed to hinder the development of a space that is supportive of a child's increasing autonomy needs, which in turn, promotes the ability for a child to make choices for themselves (vs. dependence on others; Grolnick & Pomerantz, 2009). Further, imposing parental values through psychological control techniques, irrespective of a child's own needs and values, can lead to disturbances in identity formation during adolescence and beyond, marked by low commitment-making and high levels of indecisiveness

related to the roles and identities they pursue (Luyckx et al., 2007; Vansteenkiste, Zhou, et al., 2005).

Psychological control has been shown to have profound associations with a child's psychosocial well-being as they develop, especially in the development of internalizing disorders (Barber, 1996; Soenens & Vansteenkiste, 2010). Parental psychological control also is related to delinquency, externalizing problems, academic difficulties, lower executive functioning, risky sexual behavior, and poor peer adjustment from childhood through emerging adulthood (Bean et al., 2003; Bernier et al., 2010; Faherty et al., 2020; Hoeve et al., 2009; Karavasilis et al., 2003; Kincaid et al., 2011; Lanza et al., 2013; Liga et al., 2017; Nelson & Crick, 2002; Roche et al. 2005; Sidze & Defo, 2013). More broadly, psychologically controlling environments may impact learning and performance. For instance, Vansteenkiste et al. (2004) found that psychologically controlled learning contexts reduced individuals' levels of persistence on tasks, depth of information processing, and task performance. In another study, Vansteenkiste, Simons, et al. (2005) found that parental psychological control inhibited conceptual learning for 12-year-old children. Taken together, psychological control has the potential to not only impact a child's well-being and adjustment but also the underlying mechanisms that may support the development of competent decision skills.

Individual differences in decision-making competence

Historically, researchers in the behavioral decision-making (BDM) literature have examined decision-making quality by means of comparing an individual's choice to that which would be predicted by a normative model of rationality, such as Expected Utility Theory (EUT; Von Neumann & Morganstern, 1944). Because these latter choices are ones that would be made by a completely rational actor, observing an individual's deviations have been instrumental in understanding the bounds of human thought processes. Specifically, such comparisons between how people *should* answer, and how they actually do, helps illuminate *when* and *why* one fails to respond rationally. However, it is important to note that, although choices predicted by these normative models, and other similar standards like probability theory, provide mathematical, logical benchmarks for the quality/correctness of a decision, they may not always lead to a desired outcome. Nonetheless, consistently applying these principles is presumed to lead to better choices over the long run. Thus, from this perspective, what makes a "good" or "quality" decision is evaluated by the processes leading to the choice, rather than the choice's consequence (e.g., Keren & de Bruin, 2003; Vlek, 1984).

Several batteries have been developed to quantify such individual differences in the tendency to violate normative principles (Parker & Fischhoff, 2005; Stanovich, 2016). One such measure/approach, referred to as *decision-making competence* (DMC; Bruine de Bruin et al., 2007; Parker & Fischhoff, 2005), tests performance on decision-making paradigms commonly encountered in the decision-making literature, such as resistance to framing and over/under-confidence effects. These paradigms sample skills that have been identified as facilitating decision quality (Edwards, 1954; Finucane & Lees, 2005; Raiffa, 1968), including (a) judging outcome likelihoods (*belief assessment*), (b) evaluating the outcomes themselves (*value assessment)*, (c) appropriately combining of beliefs and values to arrive at a choice (*integration)*, and (d) being self-aware of the limits of one's knowledge and abilities *(metacognition*; for further discussion, see Parker & Fischhoff, 2005).

Across these skills, DMC can be evaluated in terms of either consistency of judgements (e.g., Do preferences on one problem contradict those on another?), or accuracy, in cases where an objectively correct answer can be determined (Dawes & Hastie, 2001). For instance, well-articulated values should be insensitive to irrelevant changes in the decision context (Fischhoff, 1991; Parker & Fischhoff, 2005). The invariance axiom of EUT (Von Neumann & Morganstern, 1944), states that a decision maker's preferences should not depend on the way objectively equivalent information is described or framed. However, individuals' judgments often shift because of how an attribute is presented, violating this axiom by showing an inconsistency of responses across differently-framed, but identical, choices—thus, suggestive of lower value assessment skills (Kahneman & Tversky, 1984; Parker & Fischhoff, 2005). To illustrate, Levin and Gaeth (1988) found that individuals rated ground beef as healthier and less greasy when labeled as 75% lean, compared to when it was labeled as 25% fat. Similarly, consistency for belief assessments can also be evaluated by violations of probability rules when making risk judgements. For instance, judging that the probability that an event in a subset, e.g., "What is the chance that you will get a cavity in 1 year?" cannot exceed the probability of its proper superset (e.g., "What is the chance that you will get a cavity in 5 years?; Bruine de Bruin et al., 2007; Parker & Fischhoff, 2005).

DMC can be assessed by accuracy as well, such as by examining the degree to which one makes optimal decisions by applying external decision rules or demonstrating a level of confidence in judgments commensurate with one's ability (i.e., over/underconfidence). For example, someone who scores 60% on a 10-item test should report an average level of confidence of 60%. However, individuals often miscalibrate, leading to biased judgments (McGraw et al., 2004). Similarly, judging whether a statement is true or the probability of events occurring plays a role in normative decision theory (Camerer, 1992; Fischhoff & Beyth-Marom, 1983). In this regard, accurately recognizing peers' beliefs and social norms can also be considered a test of DMC (see Parker & Fischhoff, 2005).

Individual differences in DMC performance have been observed in youth, adolescent, and adult samples, conforming to a single latent trait (Bruine de Bruin et al., 2007; Parker & Fischhoff, 2005; Parker et al., 2018; Weller et al., 2012, 2021), and has been recovered using cross-cultural versions of the battery (e.g., Bavolar, 2013; Çevik et al., 2019). Further, research has suggested that lower DMC is associated with a variety of risk behaviors, interpersonal difficulties, and other disadvantageous decision processes across the lifespan (Bruine de Bruin et al., 2007; Ceschi et al., 2017; Parker & Fischhoff, 2005; Parker et al., 2018; Weller, Ceschi, et al., 2015; Weller, Moholy, et al., 2015). For both youths and adults, low DMC scores have been associated with both lower executive function and self-regulation, which are believed to support advantageous decision making (del Missier et al., 2012; Garofalo et al., 2021; Parker et al., 2018; Weller et al., 2012, 2015, 2021). Moreover, DMC also has been associated with environmental and home variables, such as neighborhood disadvantage, household socioeconomic status, and the presence of parental substance use (Parker et al., 2018; Weller et al., 2021), suggesting the impact of broader environmental influences on its subsequent development.

The current study

In the current study, we examine the degree to which earlier parenting practices are associated with later instantiations of decision-making competence during late adolescence/emerging adulthood. We examined this research question with a longitudinal study assessing parenting practices for mother and father separately, measured at both ages 10–12 and again 2 years later at age 12–14, whereas DMC performance was measured at age 19. We predicted that lower reported parental monitoring & involvement, lax parental control, and greater psychological control would be independently associated with lower DMC, accounting for relevant covariates (i.e., neighborhood disadvantage, presence of parental Substance Use Disorder; SUD).

Method

Participants

This study involved secondary data analysis. Participants in the original study were recruited from a longitudinal study from the Center for Education and Drug Abuse Research (CEDAR). CEDAR participating families included the biological father, mother, and a son or daughter who was between 10 and 12 years of age at study entry. Families were recruited from diverse sources to maximize representation across multiple planned subgroups. CEDAR, a longitudinal family/high-risk study of etiology of substance use disorder (SUD) recruited probands who, in this study, were adult males with or without a lifetime DSM-III-R diagnosis (DSM-IV was introduced after the study started) of SUD consequent to use of illicit drugs (SUD + and SUD−, respectively), who had a 10–12-year-old biological child (Tarter & Vanyukov 2001). The SUD + probands were recruited from substance abuse treatment programs, social service agencies, newspaper and radio advertisements, public service announcements, and random digit telephone calls. The SUD − men were recruited using the same method as SUD + probands except that none were acquired from treatment facilities. This study ran from 1990 until 2014, was reviewed and approved by the Institutional Review Board of the University of Pittsburgh (IRB0107007), adult participants provided written informed consent and minor children provided informed assent prior to implementing the research protocol. Participants were compensated for their time at the end of each assessment at a rate comparable to the U.S. minimum wage.

The protocol included a comprehensive assessment, including SUD and other mental disorder diagnoses of the parents and children, as well as collateral information about the children from one parent and the child's teacher. At baseline (T1), the study families included 344 fathers with SUD positive (SUD+) status, 350 fathers with SUD negative (SUD-) status, and 81 fathers who met the criteria for a DSM-IV Axis 1 disorder, but not for SUD. Although it was not part of the recruitment plan, Mother's SUD + status was also collected ($n = 187$). Collectively, 31.4% of the sample had one parent with SUD + diagnosis, and

18.4% with two SUD + parents. CEDAR has the following sample sizes, indicated by the number of families: T1 (ages 10–12 years): $n = 775$; Time 2, 2 years following baseline (T2; age 12–14): $n = 653$; Time 3(T3; age 19): $n = 580$. For the follow-up assessments, CEDAR maintained a 78–89% follow-up success rate between successive visits ($M = 84\%$). Attrition was not progressive; subjects missing a follow-up visit commonly returned for subsequent visits. For the current study, the sample consisted of 70.7% Males, 75.5% Caucasian, 21.8% African American, 2.7% Other/did not report). Children in the study had a median number of one sibling in the household at age 10–12. Household income was not directly assessed; however, the median household income of participants' 1990 US Census tract was $32,488; thus, approximately 5.7% of participants lived in a census tract that was below the 1990 poverty level of $13,359).

Measures

As part of the larger longitudinal study, participants completed the following measures:

Parenting practices

Parental monitoring/involvement. Children completed the *Parental Supervision/Involvement Scale* (Loeber et al., 1989) at both visits. Thirteen of these items asked the child solely about their father's monitoring/involvement behaviors, and 13 items asked solely about their mother's behaviors. These items assessed perceived supervision for each parent separately (e.g., "Does your mother/father know who you are with when you are not home?" with responses coded on a 3-point Likert-type scale from "Almost always" to "Almost never"), family talk (e.g., "When was the last time that you discussed with mom/dad your plans for the coming day?" with responses coded on a 4-point Likert-type scale from "more than a month ago" to "Yesterday/Today"), family activities (e.g., "How often do you have a friendly chat with your mom/dad?" with responses coded on a 3-point Likert-type scale from "Almost never" to "Often"), set time to be home (e.g., "Do you have a set time to be home on a school night?" with responses coded on a 3-point scale from "Never" to "Always"). A composite scale for monitoring/involvement was created for these items by averaging the z-scored items.

Children's report on parental behavior inventory (CRPBI). At T1 and T2, children rated their parent's behavior on a three-point scale (1 = *very true*; 2 = *somewhat true*; 3 = *not at all true*). Each parent was assessed separately (Schludermann & Schludermann, 1970) on the following subscales.

Psychological Control assesses the use of indirect means of control through guilt (8 items) or instilling anxiety (8 items). Statements such as "My father/mother feels hurt when I don't follow his/her advice" represent the construct of control through guilt, while statements such as "My father/mother thinks and talks about my bad behaviour long after it is over" measure instilling anxiety.

Firm (vs. Lax) Control assesses the degree to which a child perceives that a parent regulates and monitors his/her behavior by establishing firm rules (8 items) and their subsequent enforcement (8 items). An example item of firm control is "My father/mother makes me do my homework" and an item measuring rules enforcement is "My father/mother makes sure I obey even if I complain or protest."

We derived composite scales, representing three specific parenting dimensions—Parental Monitoring/Involvement, Psychological Control, and Firm Control. At both T1 and T2, the correlations between child reports on mother and father were strongly correlated for these composites (*Mean* $r = .74$ and .59, respectively). Subsequently, for each of the parenting dimensions, we created a mean composite parental scale, averaging mother and father ratings within each wave for each dimension (see online Supplementary information).[1]

Youth decision-making competence (Y-DMC)

At the age 19 (T3) assessment, participants completed the Y-DMC (see Parker & Fischhoff, 2005; Parker et al., 2018 for details about the Y-DMC measure and its scoring). The Y-DMC measures normative responding through five tasks: Applying Decision Rules, Resistance to Framing, Over/underconfidence, Consistency in Risk Perception, and Recognizing Social Norms.[2]

Applying Decision Rules assessed the ability to follow a prescribed decision rule to make a correct choice from several options in a multi-attribute matrix (adapted from Payne et al., 1993). An example is making a purchase for which the subject must decide which of 3 stores is best based on ratings of 4 features. There were seven items in total; thus, the

[1]Because we created a composite variable for parenting practices, we considered the possibility that such a composite could mask discordant parenting across children. To address this point, we calculated an intraclass correlation for the parenting variables used as a measure of profile similarity. This variable did not significantly correlate with DMC subscale scores. Further, we conducted an OLS regression to test whether it might potentially impact the associations between our study variables and DMC. These results yielded no substantive differences from the results reported, and thus not discussed further.

[2]We did not include another task, Resistance to Sunk Costs, into this measure, as it only included two items that did not correlate with the other scales (Parker et al., 2018).

Applying Decision Rules score reflects the number of correct applications of the specified decision rule given (0–7).

Resistance to Framing evaluates insensitivity to irrelevant information in a decision problem across five decision pairs. These items tested an individual's tendency to make consistent judgements across two differently presented, but objectively identical, decision problems. The Resistance to Framing score equals the number of consistent choices across these problem pairs (0–5).

Over/Underconfidence tests the degree to which an individual's confidence is calibrated to their knowledge on a variety of questions of general knowledge (e.g., "A robin's eggs are orange"), sex, and HIV/AIDS (e.g., "You can usually tell if a person has HIV/AIDS"), and drugs/alcohol (e.g., "Drinking coffee makes a drunk person think more clearly"). Participants indicated if the statement was true or false and the probability that their answer is correct (i.e., their confidence level). An individual's degree of overconfidence is calculated as one minus the absolute difference between mean confidence and percentage correct across items so that higher scores reflect better performance.

Consistency in Risk Perception assesses an individual's ability to judge risk likelihood in a consistent, rational manner. Participants were asked to evaluate the likelihood of events occurring in their lives (e.g., getting pregnant or getting someone pregnant; using marijuana) and were asked to respond with the probability of the given event occurring to them in specific time frame (1 year vs. 5 years) on a scale from 0% indicating "no chance" to 100% indicating "certainty." Likelihood ratings for a 1-year risk judgment that exceeded a 5-year risk judgment would demonstrate low consistency. A response was coded as correct response when the participant's perception that an event occurring more proximally was no larger than the probability of the same event occurring later.

Recognizing Social Norms assesses the concordance between an individual's judgment of normative behavior across a range of behaviors such as being on time for an appointment or drinking and driving with the perceived endorsement rate of others who are the same age (i.e., the sample endorsement rate). A Recognizing Social Norms score was calculated by the within-person rank order correlation (-1 to +1) between estimated social norms and the actual social norm endorsement rate of the sample.

Covariates

For the current study, we focus on three potential covariates. Child's sex (male = 0; female =1) was included because of reported differences in emerging adult risk behavior (Byrnes et al., 1999; Chapple & Johnson, 2007). Parental SUD + and neighborhood disadvantage are predictors of youth risk behaviors (Ridenour et al, 2009), and previously have been shown to account for variance in DMC over time (Weller et al., 2021). Moreover, parental SUD + is a robust predictor of negative parenting practices, such as inconsistent supervision and discipline, and conflictual interactions (Dishion et al., 1999; Latendresse et al., 2008; Tarter et al., 2003; El-Sheikh & Flanagan, 2001). Assessed at age 10–12, *Parental SUD+* status indicated the number of a child's parents who met DSM-IV criteria for a SUD, as assessed by an expanded Structured Clinical Interview for DSM-IV (SCID; Leckman et al., 1982).[3]

Neighborhood disadvantage (Ross & Mirowsky, 2001) is a metric based on United States census tract-level information regarding the family's surrounding community, such as the percent of households living below poverty, single-parent households,[4] the number of adults without higher education/degrees, and residences not inhabited by the owner. This variable represents a broad indicator of community disadvantage across various domains, including relative economic and educational disadvantage within a participants' community, rather than an indicator of any one family's own level of disadvantage. A constant was added to the index to make the score originate at zero. Higher values reflect greater disadvantage.

Data analytic plan

To handle missing data, we conducted a multiple imputation procedure in SPSS 28.0. Prior to the imputation procedure, a random seed was set using the Random Number Generator option with a Mersene Twister. Variable values were constrained to plausible values. We used the Automatic procedure in SPSS which optimally choses either a Markov-Chain Monte Carlo or a Monotone imputation based on the analysis of missing patterns. Five imputed datasets were derived from this procedure.

Composite variables were then calculated. Analyses commenced with correlation analyses, and the pooled results were reported. For the correlational analysis only, a composite score for DMC was created by calculated by regression-based factor scores of a one-factor

[3]This version has been superseded by DSM-V; however, the diagnostic criteria for SUD + has not substantively changed in any way that would impact the results of this study.

[4]The neighborhood disadvantage index adds the prevalence of poverty and of mother-only households and subtracts the prevalence of home ownership and college educated residents in the respondent's Census tract. For more information, see Ross and Mirowsky (2001).

principal components analysis for the DMC tasks. To test the prospective associations between parenting practices and later DMC performance, we conducted a structural equation model (SEM) analysis using robust maximum likelihood using MPlus 8.7 (Muthén & Muthén, 1998–2017). DMC performance was modeled as a latent variable (i.e., measurement model), whereas the predictor variables were treated as observed variables. Direct paths between the covariates and the main variables of interest (parenting at T1 and DMC) were also included in the model. We used the IMPUTATION function to conduct the SEM with the imputed data. With this method, parameter estimates, and standard errors reported represent the averages across analyses of the five imputed data sets (Muthén & Muthén, 1998–2017).

Attrition analyses

Prior to these analyses, attrition analyses first were conducted to test for any differences in parenting practices, DMC scores, and covariates between participants who took part in both T1 and T2 assessments to those with only T1 assessment ($n = 118$). With the exception that participants who had parent with a SUD + diagnosis were more likely to miss the T2 assessment than families without a SUD + parent (19.1% vs 11.3%; $\chi^2 = 8.91$, $p < .01$), we found no significant differences for either parenting practices or the DMC composite score (all p values $>.10$, mean $p = .62$).

Results

Associations between parenting variables, DMC and covariates

Table 1 reports the correlations between the study variables. As expected, we found that each of the parenting variables demonstrated moderate stability across visits, ranging from $r = .36$–$.61$. At both visits, the number of parents with SUD + status was significantly associated with lower monitoring/involvement, and greater psychological control. Greater neighborhood disadvantage was associated with greater psychological control at both visits and negatively associated with firm control and monitoring/involvement at T2.

Children with more SUD + parents scored lower on the Y-DMC measure. We also found that lower Y-DMC total scores were associated with greater neighborhood disadvantage. Y-DMC had no significant correlations with child's sex. Children who reported lower psychological control, at both T1 and T2 performed better on the Y-DMC. Greater reported parental monitoring/involvement at T2 was associated with greater Y-DMC scores, and this association was significantly stronger than at T1, $Z = 3.14$, $p < .01$ (based on formula to compare dependent correlations; Steiger, 1980). Firm (vs. Lax) control was positively associated with Y-DMC scores at T1, but not T2. However, this effect size was small ($r = .10$), and the difference between T1 and T2 correlations with DMC performance was not significant, $Z = .99$, $p = .32$. Additionally, we tested the degree to which separate reports for mother and father were differentially associated with DMC scores. As shown in Table 2, the observed correlations for mother and father ratings were remarkably similar, and in the same direction. This finding, and the observed strong correlations between parental ratings, lead us to maintain the strategy of aggregating parental ratings for the main analysis (see online Supplementary Information SI1).

Table 1. Pooled correlations for study variables.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. T1 Monitoring/Involvement	(.90)														
2. T1 Firm Control	.07*	(.90)													
3. T1 Psy Control	−0.04	−0.07	(.95)												
4. T2 Monitoring/Involvement	.43**	.10*	−0.12**	(.92)											
5. T2 Firm Control	.12*	.36**	.00	.18**	(.87)										
6. T2 Psy Control	−0.14**	.00	.61**	−0.18**	−0.14**	(.93)									
7. Neighborhood Disadvantage	−0.09*	−0.09*	.21**	−0.14**	−0.14*	.25**	–								
8. # SUD + parents	−0.13**	−0.07	.16**	−0.20**	−0.19**	.17**	.14**	–							
9. Sex (male = 0)	.05	−0.07	−0.18**	.04	−0.04	−0.08*	−0.02	−0.01	–						
10. RTF	.04	.07	−0.08*	.09	.04	−0.12*	−0.15**	−0.12*	.00	–					
11. CRP	.03	.07	−0.12**	.10*	−0.02	−0.08	−0.24**	−0.10**	.03	.18**	–				
12. ADR	.04	.04	−0.27**	.10	.08	−0.28**	−0.29**	−0.10**	.08	.21**	.24**	–			
13. OC	−0.01	.08	−0.22**	.14**	.02	−0.19**	−0.31**	−0.09*	−0.01	.23**	.23**	.34**	–		
14. RSN	−0.02	.05	−0.07	−0.03	.05	−0.11**	−0.15**	−0.08	.00	.07	12*	.25**	.12**	–	
15. YDMC-Total	.02	.10*	−0.27**	.14**	.06	−0.27**	−0.39**	−0.16**	.03	.54**	.59**	.72**	.68**	.46**	–

Note. Reported values are pooled estimates from 5 imputed datasets. RTF: Resistance to Framing; CRP: Consistency in Risk Perception; ADP: Applying Decision Rules; OC: Over/underconfidence; RSN: Recognizing Social Norms; YDMC-Total: DMC composite index, calculated by regression score for a one-factor PCA solution. *$p < .05$; **$p < .01$. Cronbach's alpha in parentheses.

Table 2. Associations between DMC and parenting practices, mother and father separately.

	RTF	CRP	ADP	OC	RSN	YDMC-Comp.
Time 1 (age 10–12 years)						
Monitoring/Involvement—F	.02	.02	.05	−0.02	.00	.02
Firm Control—F	.07	.07	.04	.06	.07*	.10*
Psychological Control—F	−0.08	−0.12**	−0.27**	−0.23**	−0.05	−0.27**
Monitoring/Involvement—M	.05	.03	.02	.00	−0.04	.02
Firm Control—M	.05	.04	.03	.08	.03	.08
Psychological Control—M	−0.07	−0.13**	−0.26**	−0.21**	−0.08	−0.26**
Time 2 (age 12–14)						
Monitoring/Involvement—F	.10	.10*	.09	.14**	.00	.15**
Firm Control—F	.04	.01	.09	.00	.10*	.08
Psychological Control—F	−0.12	−0.06	−0.29**	−0.21**	−0.06	−0.26**
Monitoring/Involvement—M	.07	.08	.09	.10**	−0.04	.11**
Firm Control—M	.02	−0.04	.04	.04	−0.03	.02
Psychological Control—M	−0.09*	−0.08*	−0.23**	−0.13**	−0.14*	−0.23**

Note. Reported values are pooled estimates from 5 imputed datasets. RTF: Resistance to Framing; CRP: Consistency in Risk Perception; ADP: Applying Decision Rules; OC: Over/underconfidence; RSN: Recognizing Social Norms; YDMC-Total: DMC composite index, calculated by regression score for a one-factor PCA solution. *$p < .05$; **$p < .01$.

SEM model

Given the stability of the parenting practices across assessments, we combined ratings for each parenting practice prior to conducting the analysis (parallel analyses can be found in online Supplementary Information for each assessment visit). The model fit the data well, mean CFI = .947, TLI = .926, RMSEA = .031. Figure 1 shows the results of the SEM analysis which tested the degree to which parenting practices, along with covariates, accounted for variance in the latent Y-DMC variable (see also Table 3 for unstandardized estimates).[5] We found that all DMC indicators significantly loaded on the latent factor, confirming that the included indicators reasonably conform to a single-factor solution. Next, we examined the degree to which the covariates independently contributed to the variance in DMC performance. Holding other variables constant, we found that only neighborhood disadvantage was significantly associated with DMC scores, with greater disadvantage being related to lower scores. With respect to parenting practices, we found that only greater psychological control was inversely associated with lower DMC scores, holding other variables constant. No other parenting variable accounted for variance in DMC scores.

Discussion

A growing body of research suggests that individual differences in decision-making competence are associated with both advantageous and disadvantageous outcomes (Parker et al., 2018; Parker & Fischhoff, 2005; Weller, Moholy, et al., 2015). However, less is known about antecedent variables that are associated with the development of these skills. The current study found that higher levels of psychologically controlling parenting during childhood and early adolescence were associated with lower decision-making performance later in life. These findings support past research emphasizing the importance of parenting on a child's social and cognitive development (Lucassen et al., 2015).

Specifically, we found evidence that parental psychological control practices were associated with a child's difficulty with making normative decisions 9 years later. This effect was found even after controlling for other parenting practices, as well as broad-reaching environmental and familial variables such as neighborhood disadvantage and parental SUD + status. These results support previous research which emphasizes the importance of instilling autonomy, rather than exerting excessive psychological control when raising children. Autonomy-granting has been found to be especially important, as it gives a child the freedom to make their own guided decisions and to form their own goals (Soenens & Vansteenkiste, 2010). Further, autonomy promotes intrinsic motivation and contributes to improved well-being and academic success (Lekes et al., 2010).

We speculate that these associations between parenting practices and decision-making may, in part, occur by shaping global dispositions in a child's self-regulatory tendencies. The association between traits related to disinhibition and self-control has been well-documented related to increases in risk behavior and suboptimal decision-making (e.g., Lauriola & Weller, 2018). Numerous studies have found that psychological control has been associated with lower self-control and emotional regulation (Finkenauer et al., 2005; Houtepen

[5]We also explored the possibility of interaction effects between parenting variables and both neighborhood disadvantage and parental SUD in a parallel model. No interaction effects were found, all $p > .45$. Thus, we do not further consider this issue.

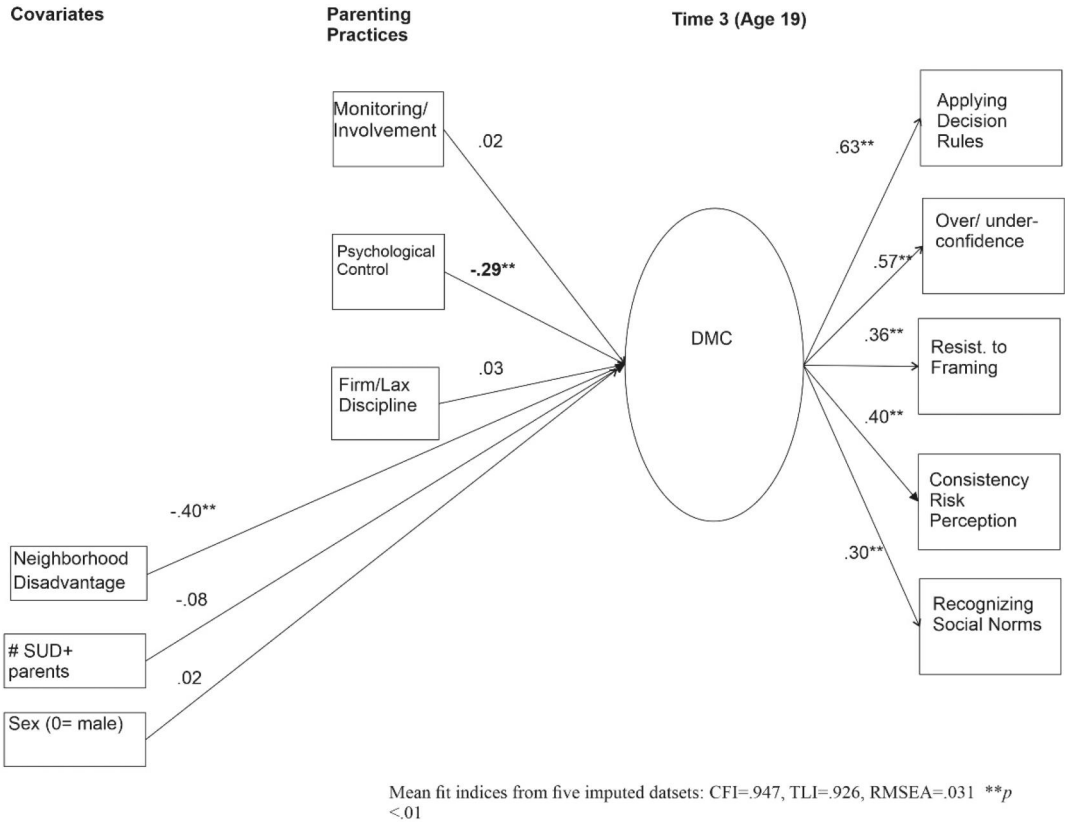

Figure 1. SEM analysis results.

Table 3. Parameter estimates-SEM.

Measurement model—YDMC	Unstd. estimate	S.E	Std. estimate	S.E
Resistance to framing	0.56**	.09	0.36**	.05
Consistency in risk perception	0.56**	.09	0.40**	.05
Applying decision rules	–	–	0.63**	.05
Over/underconfidence	0.06**	.01	0.57**	.06
Recognizing social norms	0.10**	.02	0.30**	.06
Covariates				
Neighborhood disadvantage	−0.22**	.04	−0.40**	.06
Number of SUD + parents	−0.08	.05	−0.08	.05
Sex (male = 0)	0.00	.08	0.02	.05
Monitoring/Involvement	0.00	.01	0.02	.05
Psychological control	−0.08**	.02	−0.29**	.05
Firm control	0.01	.02	0.03	.05

Note. **$p < .001$. CFI = .947, TLI = .926, RMSEA = .031. Parallel SEM for each assessment can be found in online Supplementary Information (SI2).

et al 2019; Manzeske & Dopkins Stright, 2009). In a recent meta-analysis, Pinquart (2017) reported that psychological control showed the strongest effect sizes with self-control, relative to other parenting practices. Subsequently, self-control is believed to mediate relationships between psychological control and later outcomes, such as the development of internalizing disorders and interpersonal competencies (Barber, 1996; Finkenauer et al., 2005; Moilanen & Manuel, 2017). Additionally, psychological control has been implicated in externalizing behaviors, such as aggression, delinquency, and behavioral addictions (Faherty et al., 2020; Finkenauer et al., 2005; Lansford et al. 2014; Pinquart, 2017). Notably, in a study that leveraged the same sample as the current one, Weller et al. (2021) found that youth with persistently elevated levels of psychological dysregulation, measured by an index including indicators of both self-control and negative affectivity-related tendencies, was associated with substantially lower DMC scores than their more self-regulated peers (c.f., Garofalo et al., 2021).

Contrary to our predictions, we did not find strong evidence for associations between other parenting variables and DMC performance. Greater levels of parental monitoring/involvement have been shown to provide a protective factor against health-risking and externalizing behaviors, in both cross-sectional and longitudinal designs (Bacchini et al., 2011, Barnes et al., 2006; Brody, 2003; Pilgrim et al., 2006; Siebenbruner et al., 2006). Whilst we did observe a small, but significant zero-order correlation between T2 monitoring/involvement and Y-DMC scores, it did not significantly account for DMC performance, holding other variables constant. Considering that the correlation between DMC performance and monitoring/involvement became stronger from T1 to T2, it is possible that more proximal assessments may suggest more prominent associations.

Similarly, we did not find strong evidence for associations between firm control and DMC performance. However, it must be noted that the scale used in the current study did not distinguish between firm punishments and excessively harsh ones per se, the latter of which would presumably be more detrimental (Pinquart, 2017). Parental rigidity and the enforcement of harsh punishments are considered characteristic of an authoritarian parenting style, which has been implicated in the development of both internalizing and externalizing disorders (Baumrind, 1967, 1991). Harsh parenting also has been associated with a child's cognitive abilities. For instance, Lucassen et al. (2015) found that harsh parenting (i.e., physical punishments, calling child names like "lazy" or "stupid," etc.) was associated with lower levels of a child's metacognitive abilities, and lower inhibitory self-control. In contrast, the scale used in this current study included non-enforcement of rules and lax parenting styles, without items directly reflecting perceived severity of the rules or punishments.

Additionally, although it was treated as a covariate, it should be noted that greater levels of neighborhood disadvantage predicted lower DMC performance, supporting past research. Mani et al. (2013) found that greater levels of poverty and disadvantage were associated with lower cognitive functioning on tasks like Raven's Progressive Matrices. Lower socioeconomic status also has previously been associated with lower performance on child-version of the Iowa Gambling Task (Mata et al., 2013). Notably, Weller et al. (2021) found that neighborhood disadvantage was associated with lower DMC performance, beyond that explained by a child's developmental trajectory of self-regulative tendencies. Taken together, these findings reinforce that the broader socio-economic context impacts decision making and should be examined in greater detail from a range of perspectives.

Limitations and future directions

Although this study provides unique insights into the associations between parenting practices and DMC, we must acknowledge several limitations. First, because DMC was only evaluated at one time point, this study is silent with respect to the actual development of these skills, and the degree to which parenting practices impact the developmental trajectory over time. A wide range of research reinforces a "cognitive sophistication" model, in which children's decision making begin to more closely resemble a normatively rational choice (Toplak & Flora, 2021). However, no longitudinal research exists which links parenting with the rate of developmental change toward rational responding, or if parenting may account for heterogeneity in these trajectories. Adding to this complexity, different decision-making skills may follow different trajectories across the lifespan (Romer et al., 2017; Strough et al., 2015); thus, more research is needed within a developmental context.

This limitation also leaves the current study silent with respect to potential issues of bi-directionality. Specifically, it is possible that parents enact behaviors that are responsive to their adolescents' decision-making skills. For instance, Li et al. (2019) found that not only can parenting may influence the development of self-control, but self-control may also impact which parenting practices are enacted. Similarly, Billen et al. (2022) found evidence for a bi-directional model between self-control and deviance, suggesting that self-control may not solely temporally precede risk behaviors. Longitudinal designs that include decision-making at each time period can help to further explicate the nature of the associations reported in the present study.

It is important to note that the components included in the DMC measure only represent a subset of decision skills that may indicate normatively rational responding. At its inception, and its introduction into this secondary dataset, it was intended to demonstrate that (a) individual differences in decision-making tendencies could be quantified *via* different decision-making paradigms encountered in the literature, and (b) these individual differences were associated with outcomes that may indicate poor real-life decision processes. Since then, other measures, such as Stanovich's (2016) Comprehensive Assessment of Rational Thought, include other components of normatively rational responding, along with self-reported "thinking dispositions" (e.g., superstitious thinking, scientific reasoning) that may support rational choice. One skill not directly measured with the DMC, but particularly relevant, is advantageous decision making when faced with risky choices, or expected value (EV) maximization (i.e., making choices that have the most favorable long-run outcomes).[6] This skill involves integration skills of outcome probabilities and its magnitude; making risky choices when the EV suggests a more favorable option is available has been associated with other poor decision-making skills and neural regions implicated in self-regulation (Parker & Weller, 2015; Stanovich, 2016; Weller et al., 2007). Understanding how parenting

[6]The expected value of a choice is expressed by the equation, $EV = \sum \text{Probability}_i * \text{Outcome}_i$. Thus, for a choice with a 50% chance to win 100, otherwise win 0; the EV of the choice = 50.

practices are associated with risky decision making processes would further illuminate the scope of their potential impact.

With respect to our measures of parenting practices, we note two specific limitations. First, because these data come from an existing longitudinal study and the measures were previously collected, we only had parenting assessments for the age 10–12 and age 14 assessments. Subsequently, parenting practices during middle adolescence were not accounted for, but naturally, could be associated with DMC performance. Second, we acknowledge that some of the parenting constructs have since been expanded since the original assessments. In particular, the constructs of psychological control and autonomy have been elaborated upon further (Soenens et al., 2006, 2010). Although these scales have strong conceptual overlap with the ones used in this study, the newer scales may offer more refined assessments to further parse the relations between decision-making and specific components of parenting, especially with respect to psychological control.

Finally, we need to acknowledge several potential limitations with the sample. Although this sample includes a range of participants in terms of ethnicity, gender, and socioeconomic backgrounds, the fact that parenting is embedded in the aims of a larger study that was designed to examine associations with paternal SUDs, with only biological parents recruited, leaves other research questions open. Whilst the absence of significant associations between parental SUD + and DMC performance, after controlling for parenting and broader neighborhood disadvantage, provides confidence that the observed associations are not directly related to parental SUD status, we cannot speak to how parenting may differ in households where at least one biological parent is not present, for instance. Additionally, the observed associations with respect to parenting must be considered within the culture in which they are assessed. Shigeto et al. (2019) found that longitudinal associations between psychological control and depressive symptoms was similar for Latinx and non-Latinx families, but the associations between behavioral control (measured with items from the CRPBI Firm Control scale), differed in sign across cultural background. In another study across twelve cultural groups, Lansford et al. (2018) found that the normativeness of parenting practices across cultures moderated effects between youth adjustment and parenting (c.f., Deater-Deckard & Dodge, 1997). As parenting practices vary across cultures, these associations should be assessed and examined with other populations to help gain a more global representation of these associations.

Overall, these findings may have implications for prevention and intervention purposes. Specifically, this research reinforces the importance of environmental factors, especially parenting. Knowing how parenting may be associated with decision-making abilities is important for both identifying children who may be susceptible to making maladaptive choices later in life, as well as potentially developing interventions that may contribute to improved decision-making skills. At the school level, interventions of this kind have been tested with positive preliminary results. Jacobson et al. (2012) found that adding a decision-making skills supplementary component to a high school history course not only improved grades, but also improved later decision-making abilities. Similarly, Weller et al. (2015) found that a family-based, skill building intervention (given at age 11) improved later integration skills for risky choices (i.e., making choices consistent with expected value, also related to DMC; Parker & Weller, 2015), measured at age 16, for maltreated adolescent girls in foster care, compared both to girls receiving foster care services as usual, and non-maltreated peers. It is likely that interventions that target both decision skills and supporting competencies like self-control and parent-child communication, will yield maximum benefits.

In summary, these findings contribute to and support past decision-making research that has highlighted parenting and cognitive abilities. The developmental period under study corresponds with a transition from middle-school to high school in many education systems. This transition can be particularly difficult for children, especially those in vulnerable groups, not only in terms of navigating new academic challenges but also social ones (Kim & Leve, 2011). It is also a time in which health-risking behaviors first manifest (Reyna & Farley, 2006). By showing that parenting practices are associated with later decision-making tendencies, the current study provides insights into underlying mechanisms that may link parenting to the development of problem behaviors (Barber et al., 2005; Dishion et al., 1991; Patterson & Stouthamer-Loeber, 1984). Recognition of such antecedents may lead to the development of interventions that target ways to reduce risk behaviors, as well as highlight ways that parents can aid in improving their children's decision skills that may promote long-term social, financial, and health outcomes.

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Authors contributions

All authors contributed to the design of the study. J. Weller, L. Michaels, A. Parker, and M. Reynolds conducted the literature review. M. Reynolds and L. Kirisci developed the dataset from the existing longitudinal study. J. Weller and L. Kirisci conducted the statistical analyses. J.A. Weller wrote the first draft of the manuscript and all authors contributed to and have approved the final manuscript. Early analyses of these data were conducted by L. Michaels as part of an undergraduate honors thesis.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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Data availability statement

The data that support the findings of this study are available through upon reasonable request to Joshua Weller (email: j.weller@leeds.ac.uk).

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