EXAMINING PARENTAL KNOWLEDGE AND INVOLVEMENT AS PREDICTORS OF ADOLESCENT IMPULSIVITY AND ALCOHOL USE INTENTIONS AND FREQUENCY

by

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DISSERTATION ABSTRACT

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Title: Examining Parental Knowledge and Parental Involvement as Predictors of Adolescent Impulsivity and Alcohol Use Intentions and Frequency

Prior work has shown that parental knowledge and involvement can have protective effects on adolescent alcohol use; however, less is known about how different dimensions of impulsivity might mediate this association. Guided by the self-control theory and more recent brain network-based models of impulse control development, the present study analyzed data from 345 middle-schoolers to examine the direct effects of parental knowledge and parental involvement on adolescent alcohol use intentions and frequency, as well as their indirect effects through acting without thinking (AWT), delay discounting (DD), and attention control difficulties (AD). Consistent with prior evidence, results revealed direct protective effects of parental knowledge on adolescent alcohol use intentions and frequency as well as direct protective effects of parental involvement on adolescent alcohol use frequency. Of the three impulsivity dimensions, only AWT mediated the association between parental knowledge and adolescent alcohol use frequency. Accounting for the effect of AWT, DD and AD were not significantly associated with alcohol use intentions or frequency, and did not operate as significant mediators of parental effects. The present study advances our understanding of how parenting behaviors can impact adolescent alcohol use both directly as well as indirectly through associations with adolescent impulsivity, specifically AWT. Given that AWT

may be sensitive to environmental inputs, such as parenting, findings from the current study provide support for parenting interventions that target AWT as an avenue for preventing adolescent alcohol use, in addition to existing approaches that focus on parental rule setting and supervision. Future research should further examine the mediating role of impulsivity with larger samples using longitudinal designs.

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CHAPTER I

INTRODUCTION

Adolescent alcohol use is a serious public health problem in the United States, with 1 in 3 high school students reporting alcohol use in the past 30 days (Jones et al., 2020). The 2019 Youth Risk Behavior Survey found that the prevalence rate of alcohol use among adolescents was the highest compared to all other substances, accounting for 29.2% of total substance use within the past 30 days (Jones et al., 2020). Alcohol use initiation during early to mid adolescence is associated with an increased likelihood of developing alcohol use disorder (DeWit et al., 2000; Grant & Dawson, 1997), increased drinking frequency, and increased motivation to drink excessively as an adult (Ohannessian et al., 2015). Additionally, early alcohol use onset and progressive use can have deleterious effects on adolescent brain regions associated with reward processing, cognitive control (Koob & Volkow, 2016), attention, and memory (De Bellis et al., 2000; Hanson et al., 2011; Squeglia et al., 2009), which can further exacerbate risk for addiction and alcohol relapse (Koob & Volkow, 2016).

Adolescence is a developmental period where risk taking behaviors, such as alcohol use, first emerge. This has been linked to a number of factors, including heightened desire in adolescence to experiment with novel behaviors, peer socialization, access to alcohol use through peers, and ongoing development of impulse control. Specifically during early adolescence, neural connectivity between different brain regions become more integrated (Dennis et al., 2013). Brain networks supporting cognitive processes including specialized neural areas, such as the prefrontal cortex, frontoparietal tracts (Cohen et al., 2014; Simmonds et al., 2013), cingulo-opercular networks (Cohen et

al., 2014), the dorsolateral prefrontal and dorsal anterior cingulate cortices, and dopamine driven midbrain regions (Luna et al., 2015), become well integrated resulting in increased and consistent utilization of top-down networks that engage cognitive control (Hwang et al., 2010; Luna & Sweeney, 2004) in behavioral decision making (Luna et al., 2015).

It is also important to note that while most adolescents engage in some amount of experimentation, not all youth engage in maladaptive forms of risk-taking that are linked to adverse outcomes (Romer et al., 2017). Adolescents who display early deficits in impulse control are more likely to engage in maladaptive forms of risk-taking, such as progressive substance use (Bjork & Pardini, 2015; Moffitt et al., 2011). These deficits in impulse control increase vulnerability for early alcohol use onset and progressive drinking (Khurana et al., 2013). As such, in order to prevent adolescent alcohol use, it is imporant to identify malleable factors that can directly reduce involvement in such behaviors (through reduced opportunities and socializing influences), but also indirectly impact risk behavior outcomes by strengthening impulse control abilities.

Parents can play a key role in preventing and delaying alcohol use onset in adolescents (Sandra & Emmanuel, 2016). Systematic reviews have found protective effects of parenting behaviors, including general parental support, parental knowledge, parental limit/rule setting, positive parent-child relationship quality, parental involvement, and parental modeling, on adolescent alcohol use outcomes (Ryan et al., 2010, 2015; Sandra & Emmanuel, 2016). Specifically, parents who are more knowledgeable about their adolescents' activities, whereabouts, and peer groups can limit access and influence of substance-using peers, thereby protecting their adolescent from alcohol exposure and risky situations (Yap et al., 2017). Parents who are involved and

spend time with their adolescent can discuss the consequences of early drinking and model appropriate alcohol behaviors (Yap et al., 2017). Parents may also indirectly influence adolescent alcohol use through their impact on adolescents ability to control impulses.

The self-control theory has been used to explain how parental factors can influence adolescent risk behaviors, such as alcohol use, through the development of child/adolescent self-control. Self-control, according to Hirschi and Gottfredson (1994), is defined as "the tendency to avoid acts whose long-term costs exceed their momentary advantages" (p. 3), which is similar to how I am defining impulse control (or lack of impulsivity) in this study. This theory postulates that low self-control in adolescence increases risk for a range of problem behaviors including juvenile delinquency, substance use, gambling behaviors, and sexual risk behaviors (Gottfredson & Hirschi, 1990; Paternoster & Brame, 1998), and identifies parenting behaviors, such as parental monitoring and engagement, as predictors of adolescent self-control (Gottfredson & Hirschi, 1990). Past studies using the self-control theory have found that parental inputs, such as parental involvement and monitoring, can reduce risk for adolescent delinquent behaviors including substance use (Yap et al., 2017), and this effect operates through parental influences on impulse control for adolescents (Feldman & Weinberger, 1994; Wills et al., 2004) and emerging adults (Gibbs et al., 1998; Hay, 2001; Patock-Peckham & Morgan-Lopez, 2006).

Recent neuroimaging research on the neurocircuitry underlying adolescent self-control has found that these circuits are rapidly maturing in adolescence, shaped by environmental inputs (e.g., parental influences; Gee et al., 2018) and adolescents

experiences (e.g., experimentation with novel behaviors; Luna et al., 2015). Building on the neurobehavioral imbalance models (Casey et al., 2008; Khurana et al., 2015a), which emphasize an imbalance between reward motivation and cognitive control capacities, recent integrated network-based models document how the integration and connectivity between brain networks associated with reward processing and cognitive control contribute to development of impulse control (Gee et al., 2018). These models emphasize the role of environment and experience in shaping and strengthening the neural circuitry associated with impulse control in adolescence (Gee et al., 2018; Luna et al., 2015). As such, environmental inputs like parenting behaviors can influence impulse control development in adolescence, and therefore may serve as a mediational pathway through which parental influences reduce risk-taking in adolescence.

Although there is growing evidence supporting the role of parenting behaviors in promoting self-control in younger years (Eisenberg et al., 2010; Raver, 2004), less is known about whether parenting behaviors can also impact self-control in adolescents, and further through that, influence adolescent risk behaviors, as suggested by the self-control theory. Some studies have found that adolescent self-control significantly mediated the relationship between parenting behaviors (ineffective parenting, parental knowledge, parental discipline) and delinquency (Feldman & Weinberger, 1994; Gibbs et al., 1998) and alcohol use (Wills et al., 2004) among adolescents and emerging adults (Gibbs et al., 1998; Hay, 2001). Additionally, one study found significant mediation of impulse control on the association between parental knowledge/involvement and alcohol use among emerging adults (Patock-Peckham & Morgan-Lopez, 2006); however, relatively limited research has been conducted on indirect effects in adolescent samples. Given the

plasticity of underlying nurocircuitry associated with impulse control, it is important to examine indirect effects of parenting behaviors through adolescent impulse control.

Impulsivity is a multidimensional construct (Whiteside & Lynam, 2001), which includes several dimensions including acting without thinking (AWT; also known as impulsive action), delay discounting (DD; also known as impulsive choice or inability to delay gratification), and attention control difficulties (AD; Whiteside & Lynam, 2001). These distinct dimensions are found to have unique associations with adolescent risk-taking behaviors and with indicators of executive cognitive abilities such as working memory (Khurana et al., 2017). A few studies have documented parental effects on adolescent impulsivity dimensions (e.g., King et al., 2013; Li et al., 2019; Khurana et al., 2015b), but few have examined the mediating role of distinct dimensions of impulsivity, such as impulsive action vs. impuslive choice, and difficulties with attention control. These dimensions can not only uniquely predict adolescent risk behaviors but can also be differentially impacted by parental inputs. To address this gap, this dissertation will test the direct and indirect effects of parental knowledge and parental involvement on adolescent alcohol use intentions and frequency, as mediated by three distinct impulsivity dimensions, namely AWT, DD, and AD. To examine the potential unique influences of AWT, DD, and AD, I will test their mediational role using a parallel mediation model. I elaborate on these dimensions and their associations with adolescent alcohol use (Stautz & Cooper, 2013) below.

Impulsivity Dimensions

Acting without thinking (AWT). Also referred to as impulsive action, AWT is defined as the tendency to act without much forethought to the consequences of one's

behavior (Khurana & Romer, 2019). AWT represents a weakness in top-down control (Romer et al., 2011) and is inversely related to working memory (Khurana et al., 2012). Studies have shown that AWT peaks during adolescence (Collado et al., 2014; Khurana et al., 2018), and has consistently been linked to engagement in risk behaviors in adolescent samples, including alcohol use and dependence (Khurana et al., 2013, 2017).

Delay discounting (DD). Also referred to as impulsive choice, DD is defined as the ability to delay gratification in the context of rewards with varying delays (Khurana & Romer, 2019). Adolescents who are high in DD tend to choose smaller and more immediate rewards instead of larger more delayed rewards. Like AWT, DD is also inversely related to working memory (Shamosh et al., 2008). Adolescents who tend to discount delayed rewards are at greater risk for engaging in early alcohol use (Khurana et al., 2013) and progressive drinking (Khurana et al., 2015b).

Attentional control Difficulties (AD). Attentional control is defined as the ability to sustain attention on a specific task at any given time. Attentional control works in tandem with working memory in order to receive, maintain, and manipulate information in the moment (McCabe et al., 2010). It consists of the ability to focus and shift attention in a goal-directed manner. Adolescents who experience attentional control difficulties (AD), tend to struggle with higher-order executive functions like planning (Malloy-Diniz et al., 2007), delay of gratification (Rodriguez-Jimenez et al., 2006), impulse control (Stanford et al., 2009), and short-term working memory (Whitney et al., 2004). Deficits in executive attention have also been associated with progressive and compulsive substance use (Bickel et al., 1999).

Historically, impulse control has been categorized as a relatively stable personality trait (Eysenck & Eysenck, 1984); however, recent research has provided evidence that there is significant variability in the developmental trajectories of impulsivity dimensions (Khurana et al., 2018) from childhood to adolescence, which has been related to environmental inputs, such as parental influences (Li et al., 2019). Given the neuroplasticity underlying cognitive control during this developmental stage (Gee et al., 2018; Luna et al., 2015), examining modifiable factors that may strengthen impulse control, such as parental inputs, is pertinent in considering prevention of early alcohol use.

Parental Effects on Adolescent Substance Use

Despite increasing influence of peers in adolescence, parents continue to have a significant impact on adolescent risk behaviors, including alcohol use onset and progression (Dishion et al., 2004). A number of parental factors, including poor parent-adolescent relationship quality (Norem-Hebeisen et al., 1984), lack of positive parental involvement, low levels of parental monitoring (Dishion et al., 2004), and poor parent-adolescent attachment are associated with increased risk of adolescent substance use (Patock-Peckham et al., 2011). Of these parenting behaviors, parental knowledge and parental involvement have consistently been associated with adolescent alcohol use (Ryan et al., 2010), and thus, will be the focus of this dissertation.

Parental knowledge. Parental knowledge of their adolescents' whereabouts, activities, and friends (Stattin & Kerr, 2000) has been linked to lower rates of alcohol use in adolescents (Bahr et al., 2005). Parents who are more knowledgeable of their adolescent's whereabouts and friends will be more likely to restrict opportunities for

adolescents to engage in alcohol use and limit deviant peer influence (Dishion et al., 2004). However, studies have shown that this parental management strategy is most effective in the context of positive parent-adolescent relationships (Li et al., 2019; Stattin & Kerr, 2000), as parental knowledge is dependent on adolescent self-disclosure, which is more likely to happen in the context of trusting parent-adolescent relationships. Parental knowledge could thus be an indicator of parent-adolescent relationship quality, as parents who are more aware likely have adolescents who self disclose to their parents (Fletcher et al., 2004). Furthermore, studies have found parental knowledge to be particularly protective during early to mid adolescence compared to late adolescence, when peer influences become more salient in predicting alcohol use and other risk behavior engagement (Dishion et al., 2004).

Parental involvement. Parental involvement (e.g., positive support, spending time together) has also been found to have a direct protective influence on adolescent alcohol use (Khurana et al., 2015b; Yap et al., 2017). Parents who are involved and spend time with their adolescent reduce the likelihood of adolescent engagement in risky behaviors and exposure to deviant peer influence through reducing non-supervised leisure time in which adolescents may engage in substance use (Koutakis et al., 2008; Wood et al., 2004). A recent meta-analysis found that positive parental involvement had longitudinal effects on decreasing adolescent alcohol use and misuse (Yap et al., 2017). Additional intervention studies testing this relationship have found promising support for the benefit of parent involvement on reducing adolescent substance use through providing strategies for parents to be more involved in the lives of their adolescents (Koutakis et al., 2008; Schinke et al., 2009). Although the effect of parental involvement

on alcohol use may diminish over time, research provides support that parental involvement can have lasting effects on substance use behaviors throughout adolescence and emerging adulthood (Yap et al., 2017).

Parental Effects on Adolescent Impulse Control

Additionally, some studies have found parental involvement to be prospectively associated with self-control in adolescents (King et al., 2013; Khurana et al., 2015b). Specifically, lack of positive parenting and increased parental rejection is found to be negatively associated with adolescent self-control (King et al., 2013). In another longitudinal study, parental involvement (e.g., spending time together) was associated with lower AWT and adolescent alcohol use (Khurana et al., 2015b) at future waves. These results provide support for the effects of parental inputs on adolescent impulse control, which will be examined in this paper.

Greater parental involvement (Unnever et al., 2003) as well as time investment with their children (Bono et al., 2016) may serve as protective factors for adolescent self-regulation through modeling impulse control, providing predictable and supportive contexts for emotion-regulation development (Pallini et al., 2018), and practicing self-control behaviors through opportunities provided by parents (Li et al., 2019). Aligned with the self-control theory, as primary socializing agents, parents can impart family values and teach self-regulation to their adolescents (Gottfredson & Hirschi, 1990). Even though parental knowledge and parental involvement tend to be positively associated, there is some evidence of differential effects on adolescent impulsivity with parental involvement having stronger effects on adolescent AWT and risky behaviors (through strengthening self-control) than parental knowledge (Khurana et al., 2015b). Given the

dearth of research within this area, I examined the unique effects of parental knowledge and parental involvement on adolescent alcohol use through three impulsivity dimensions (AWT, DD, AD).

The Present Study

Although the direct protective effects of parental influences on adolescent alcohol use are well documented (Yap et al., 2017), less is known about their indirect effects through influencing adolescent impulse control, specifically AWT, DD, and AD. This dissertation will provide a better understanding of the effects of parental knowledge and involvement on early adolescent alcohol use intentions and frequency by examining their direct and indirect effects through three distinct dimensions of impulsivity (AWT, DD, and AD).

I will analyze longitudinal data collected as part of a research study conducted at a public middle school in the Pacific Northwest region of the United States. Data were collected at two time points – Fall 2017 (baseline) and Spring 2018 (6-month follow up). At both assessments, adolescents completed surveys on risk behaviors including alcohol use, executive functions, personality characteristics, parenting behaviors, and demographic information. The present study will analyze baseline (T1) and follow-up (T2) data to address the following research questions:

Research Question 1: Is parental knowledge (at T1) significantly associated with adolescent alcohol use intentions and alcohol use frequency (at T2)?

Hypothesis 1: Consistent with previous findings that parental knowledge serves as a protective factor for adolescent alcohol use, it is hypothesized that parental

knowledge will be negatively associated with adolescent alcohol use intentions and alcohol use frequency.

Research Question 2: Is parental involvement (at T1) significantly associated with adolescent alcohol use intentions and alcohol use frequency (at T2)?

Hypothesis 2: Consistent with previous findings that parental involvement serves as a protective factor for adolescent alcohol use, it is hypothesized that parental involvement will be negatively associated with adolescent alcohol use intentions and alcohol use frequency.

Research Question 3: Is the effect of parental knowledge (at T1) on adolescent alcohol use intentions and frequency of use (at T2) mediated by impulsivity dimensions (AWT, DD, AD) at T2?

Hypothesis 3: Consistent with previous findings that parental knowledge, compared to parental involvement, is less predictive of adolescent risk behaviors through adolescent impulsivity (Khurana et al., 2015b), it is hypothesized that the three impulsivity dimensions (AWT, DD, AD) will only partially mediate the potential effect of parental knowledge on adolescent alcohol use intentions and frequency of use.

Research Question 4: Is the effect of parental involvement (at T1) on adolescent alcohol use intentions and frequency of use (at T2) mediated by three impulsivity dimensions (AWT, DD, AD) at T2, using a parallel mediation model?

Hypothesis 4: Consistent with previous findings that parental involvement is associated with less risk behavior engagement through adolescent impulsivity (Khurana et al., 2015b), it is hypothesized that the three impulsivity dimensions

(AWT, DD, AD) will independently mediate the potential effect of parental involvement on adolescent alcohol use intentions and frequency of use.

CHAPTER II

METHODS

Participants & Procedures

Data were obtained from a sample of 345 middle-schoolers (M_{age} = 12.65 ± 0.67 years; 47% females) recruited from a public school in the Pacific Northwest region of the United States. Participants were assessed in the classrooms at two time-points, six-months apart. All 7th and 8th grade students in the middle school were invited to participate. Parental notification letters were mailed to the students' homes. Student assent was obtained in the classrooms by research team members. Students were surveyed if they assented to be part of the study and if their parents did not opt them out. Of the 374 eligible students, 345 participated in the T1 assessment. There was 7.53% loss to follow-up at T2. At both time points, data were collected using self-report surveys on school computers during designated class time. Research staff members were available to answer questions. Students were compensated for their time and participation in the study. All study procedures were reviewed and approved by the appropriate institutional and school district review boards.

Measures

Parental knowledge (T1). Parental knowledge was assessed using eight questions from the *Parental Monitoring Scale*, which evaluated adolescent perceptions of parental knowledge (Kerr et al., 2010). Specifically, adolescents were asked, "how often do your parents know" - 1) Where you go when you are out with friends at night, 2) What you do during your free time, 3) What type of homework you have, 4) What you spend your money on, 5) Who you have as friends, 6) How you do in different subjects at

school, 7) Where you go and what you do after school, and 8) When you have an exam or paper due at school. Response options ranged from "never" (1), "rarely" (2), "sometimes" (3), "a lot of the time" (4), and "always" (5). Students who responded "I don't know" (n = 4) were coded as missing. Responses on the eight items were averaged to create a composite score of parental knowledge which ranged from 1-4 (α = 0.85; M = 2.87, SD = 0.83).

Parental involvement (T1). Parental involvement was assessed using three questions: 1) My parents or the adults who take care of me spend time just talking with me, 2) You eat dinner with your parents, and 3) My family does something fun together. Response options ranged from "never" (1), "a few times a month" (2), "a few times a week" (3), and "almost everyday" (4). Students who responded "I don't know" (n = 2) were coded as missing. Responses on the three items were averaged to create a composite score of parental involvement which ranged from 1-4 (α = 0.63; M = 1.96, SD = 0.71).

Acting without thinking (T2). Acting without thinking was assessed using nine dichotomous (yes/no) items, including: 1) Do you often get so "carried away" by new and exciting ideas that you never think about things that might go wrong?; 2) Do you often get into a jam because you do things without thinking?; 3) Do you usually buy things without thinking?; 4) Do you often need to use a lot of self-control to keep out of trouble?; 5) Do you usually think carefully before doing something (reverse coded)?; 6) Do you usually do and say things without stopping to think?; 7) Do you often do things on the spur of the moment; 8) Do you often get involved in things you later wish you could get out of?; and 9) Do you usually speak without thinking things out? Responses on

the nine items were averaged to create a composite AWT score which ranged from 0-1 (α = 0.79; *M* = 0.43, *SD* = 0.30).

Delay discounting (T2). Delay discounting was assessed using a modified version of a behavioral task created by Green and colleagues (1994). The task asks participants to imagine being paid through a variety of jobs, such as pet sitting, yard work, or babysitting. Participants were asked to imagine being offered $100 as pay if the participant waited six months from completion of the job for payment. The first question asked participants if they would immediately accept $50 or wait six months for the $100. Following this question, participants were presented with varying reward options which started with the choice of immediately accepting $40 instead of waiting and decreased by $10 increments until they were offered the least amount, $10. The last questions started with the choice of immediately accepting $60 instead of waiting and increased by $10 increments until they were offered the most amount, $90. Responses included "Waiting for $100" or immediately "Accepting" the alternative amount of money. Responses were coded such that higher scores were indicative of greater delay discounting and ranged from 10-100 (*M* = 39.07, *SD* = 28.84).

Attentional control difficulties (T2). Attentional control difficulties were assessed using seven items from the Attention Control Sub-scale of the *Rothbart's Early Adolescent Temperament Questionnaire* (EATQ; Rueda et al., 2005). Participants were asked to read statements and select a response that best described how true each statement was for them. The statements included: 1) It is easy for me to really concentrate on homework (reverse coded); 2) When interrupted or distracted, I forget what I was about to say; 3) I find it hard to shift gears when I go from one class to another at school;

4) When trying to study, I have difficulty tuning out background noise and concentrating; 5) I am good at keeping track of several different things that are happening around me (reverse coded); 6) I tend to get in the middle of one thing, then go off and do something else; and 7) I pay close attention when someone tells me how to do something (reverse coded). Responses ranged from "almost always untrue" (1), "usually untrue" (2), "sometimes true, sometimes untrue" (3), "usually true" (4), and "almost always true" (5). Students who responded "I don't know" (n = 26) were coded as missing. Responses on the seven items were averaged to create a composite score which ranged from 1-5 (α = 0.61; M = 2.81, SD = 0.60), with higher scores indicating more difficulties with attentional control.

Adolescent alcohol use intentions (T2). Alcohol use intentions were assessed at T2 using one dichotomous (yes/no) item asking if the participant thought they might have at least 1 drink of alcohol (beer, wine, wine coolers, liquor such as rum, gin, vodka, or whiskey) within the next 6 months. Participants were told that a drink of alcohol is defined as one 12 oz. can, one bottle of beer, one 4 oz. glass of wine, one mixed drink, or one shot of liquor. Of the sample, 226 (65.50%) participants responded "no" to alcohol use intentions within the next 6 months (0), 63 (18.30%) participants responded "yes" to alcohol use intentions within the next 6 months (1), and 56 (16.20%) participants were coded as missing data (30 participants responded "I don't know" and 26 participants were lost to follow-up).

Adolescent alcohol use frequency (T2). Alcohol use frequency was assessed at T2 using participant's response to two questions. The first question assessed lifetime alcohol use with the following question: "Have you ever had a drink of alcohol?" 201

(58.30%) participants reported no lifetime alcohol use (0), 103 (30.10%) participants reported lifetime alcohol use (1), and 41 (11.60%) were coded as missing. Participants who responded "yes" to ever engaging in alcohol use, were asked the follow-up question: "In the past 30 days, on how many days did you have at least one drink of alcohol?" Responses ranged from 1 (0 days) to 7 (all 30 days). Of the participants who were asked this question, 71 participants reported no use within the past 30 days (0), 18 reported 1 or 2 days of use (1), 3 reported 3 to 5 days of use (2), 4 reported 6 to 9 days of use (3), 2 reported 10 to 19 days of use (4), 1 reported 20 to 29 days of use (5), no participants reported all 30 days of use (6), and 4 participants responded "I don't know".

Based on the distribution, responses were recoded into 3 categories (0 = no lifetime alcohol use; 1 = lifetime alcohol use but not within the past 30 days; 2 = lifetime use and use within the past 30 days). Of the sample, 201 (58.30%) participants reported no lifetime alcohol use (0), 71 (20.60%) reported lifetime alcohol use but not within the past 30 days (1), 28 (8.10%) reported lifetime use and use within the past 30 days (2), and 45 (13.00%) were coded as missing.

Control variables. Adolescents who are older, male, White or Hispanic, and from lower socioeconomic status (SES) backgrounds are more likely to engage in alcohol use as compared to younger, male, non-Hispanic Black (Windle, 2003), and higher SES adolescents respectively (Brown et al., 2001). Given these associations, the following control variables were included in the analyses.

Age. Participants self-reported age from 11 to 14 years old. Responses were collapsed into 3 categories: 11-12 years old (n = 150; 43.50%), 13 years old (n = 161;

46.70%), and 14-15 years old (*n* = 33; 9.57%). One (0.23%) participant was coded as missing.

Sex. Participants self-reported sex from the following four items: 1) Male, 2) Female, 3) Other, and 4) I don't know. The distribution of categories was as follows: 181 (52.50%) self-identified as male, 162 (47.00%) self-identified as female, and 2 (0.50%) participants responded "Other" or "I don't know". Responses for "Other" and "I don't know" were coded as missing.

Race-ethnicity. Race-ethnicity information was obtained from school records for greater accuracy (Ensminger et al., 2003). Given the distribution, this variable was recoded into three groups: Hispanic (29.28%), Non-Hispanic White or European (58.84%), and Non-Hispanic Other (11.88%), which included American Indian/Alaska Native, Black/African American, Asian, Native Hawaiian or other Pacific Islander, and more than one race.

Socioeconomic status. Socioeconomic status was assessed using eligibility for free or reduced school lunch program. Family income must be less than $15,171, or below 130% of the poverty line, to be eligible for the free lunch program (National Center for Education Statistics, 2017). Over half of the sample (*n* = 199; 57.70%) reported free or reduced lunch eligibility, 112 (32.50%) participants reported no free or reduced lunch eligibility, and 34 (9.80%) participants were coded as missing.

Analytic Plan

To address my research questions, I utilized path analysis with logistic regression for the binary outcome of alcohol use intentions and ordinal regression for the ordered outcome of alcohol use frequency. For the mediation models, I used parallel mediation to

examine the unqiue mediating role of AWT, DD and AD. Parameter estimates for logistic and ordinal regressions used weighted least squares mean variance (WLSMV), which is less biased than bootstrapping and diagonally weighted least squares (DWLS) methods for binary and ordinal outcomes with 3 response categories (Gana & Broc, 2019; Muthén, 1984). A Monte Carlo approach was used to obtain confidence intervals for the multiple imputated data (Preacher & Selig, 2012). One thousand replications were used for each Monte Carlo simulation. The following packages were used to test the models in R 3.6.2 (R Core Team, 2019): lavaan (Rosseell, 2012), psych (Revelle, 2020), semPlot (Epskamp, 2019), semTools (Jorgenson et al., 2021), ggplot2 (Wickham, 2016), tibble (Müller & Wickham, 2020), tidyr (Wickham, 2020), readr (Wickham, 2020), purrr (Henry & Wickham, 2020), dplyr (Wickham et al., 2020), stringr (Wickham, 2019), and forcats (Wickham, 2020).

Before data screening and analyses, an apriori power analysis using MedPower (Kenny, 2018) was conducted with key variables. Using .8 as the desired power, .30 for effects for paths a and b, and .10 for paths c' at a .05 alpha level, the power analysis revealed that $N = 214$ is recommended to detect total effects and an $N = 113$ is recommended to detect indirect effects (Kenny, 2018). Additionally, MedPower was used to examine the ability to detect effect sizes of parallel mediators (AWT, DD, AD). Kenny (2018) argued against using previously suggested recommendations for standardized indirect effects of mediation models (Shrout & Bolger, 2002), which proposed standards of small (.01), medium (.03), and large (.05) effect sizes. Instead, Kenny (2018) argued for squared effect size standards since indirect effects are a product of two effects. Therefore, results from this power analysis used his suggested guidelines for detecting

small (.01), medium (.09), and large (.25) indirect effect sizes of mediation models (Kenny, 2018). The power analysis for detecting indirect effects with my sample size (N = 345), revealed that the effect sizes for direct effects are large (β = .30), total effects are medium (β = .19), and indirect effects through parallel mediators are medium (β = .09). According to Kenny's (2018) guidelines, the current sample has enough power to detect parallel mediation effects of medium effect size with a .8 statistical power (Cohen, 1988; Fritz & MacKinnon, 2007).

Data Screening. Prior to testing the models, data were screened for outliers, multicollinearity, and assumptions relevant to each model (e.g., linearity and multicollinearity for logisitic regressions and propotional odds assumptions for ordinal regressions). Overall, assumptions were met for logistic and ordinal regressions. I found no significant outliers (>3 *sd*) for all models. To assess multicollinearity, I examined the variance inflation factor (VIF) for AWT and AD to identify possible issues with multicollinearity given their high correlation (r = .54, p<.001). The logistic regression models had low VIF scores within acceptable ranges (VIF < 2). The ordinal regression model examining parental knowledge as a predictor had high VIF scores for DD (VIF = 31.45) and AD (VIF = 24.31). Similarly, VIF scores for the ordinal regression model examining parental involvement as a predictor were high for DD (VIF = 31.42) and AD (VIF = 21.17). In order to address multicollinearity in my mediation models, I included covariances to account for possible issues. To examine proportional odds assumptions, I used the brant test (Schlegel & Steenbergen, 2020) for parallel regression assumptions. Ordinal regression models examining parental knowledge and parental involvement as

predictors found significant results for all key variables, indicating that the parallel regression assumptions were met.

Additionally, correlations were examined between the three impulsivity dimensions (AWT, DD, AD) to determine whether latent constructs needed to be modeled. Following guidelines (Gunzler & Morris, 2015; Marsh et al., 2004), I used a cutoff score of $r = 0.80$ or higher for correlations between my impulsivity dimensions (AWT, DD, AD) to determine if a latent factor of impulsivity should be used. Correlation results indicated that none of the correlations between the impulsivity dimensions exceeded $r = 0.80$, therefore, I examined these variables as separate predictors/mediators in my models. Additionally, during model testing, I examined whether there were any significant residual covariances between the variables. Based on theory and prior research, if there was a significant residual covariance, that would be included as a model pathway.

Missing Data. Missing data were handled using multiple imputation, which replaces each missing value by data values taken from multiple iterations of distributions specifically modeled for each missing value (van Buuren, 2018). According to research examining appropriate techniques for addressing missing data in logistic and ordinal regression models, multiple imputation is recommended above pairwise deletion (Shi et al., 2020), listwise deletion, and mean substitution techniques (Buhi et al., 2008) for missingness less than 50%. Multiple imputation methods for categorical outcomes produce parameter estimates that are comparable to complete data, and therefore more reliable (Buhi et al., 2008; Camargos et al., 2011; Shi et al., 2020). With R and the package lavaan, it is recommended that the package mice is used to compute multiple

imputation techniques (Zhang, 2016). Therefore, since study variables were missing at 16%, multiple imputation methods were employed using 20 imputations with 10 iterations per imputation (van Buuren, 2018). The mice imputation package (van Buuren, 2018) in R 3.6.2 (R Core Team, 2019) using lavaan was used for multiple imputation models.

Mediation models were tested using path analyses, logistic regressions for the binary alcohol intentions outcome and ordinal regressions for the ordered alcohol use frequency outcome. Model fit was evaluated using recommended fit indices, including low chi-square test-statistics, root mean square errors of approximation (RMSEA) with values less than 0.05, values of the comparative fit indexes (CFI) with values equal to 0.90 or greater, and evaluations of residual diagnostics (Kline, 2005). Although chi square results will be examined, these tests are affected by large sample sizes therefore, these estimates will be interpreted alongside the other aforementioned model fit indices (Hu & Bentler, 1999). All analyses were conducted in R 3.6.2 (R Core Team, 2019).

CHAPTER III

RESULTS

In examining bivariate associations, parental knowledge and parental involvement were positively correlated (r = .42, p<.001). Alcohol use intentions and frequency were negatively correlated (r = -.70, p<.001), suggesting that those who were not engaging in alcohol use were more likely to report intentions of drinking in the next 6 months. The three impulsivity dimensions were also positively related. AWT and AD were strongly correlated (r = .54, p<.001), AWT was correlated with DD (r = .16, p<.01) and DD was correlated with AD (r =.17, p<.01). Both parental knowledge (r = -.26, p<.001) and parental involvement (r = -.14, p<.05) were negatively correlated with AWT. Parental knowledge was also negatively correlated with DD (r = -.15, p<.01) and AD (r = -.17, p<.01). See Table 1 for correlations, means, standard deviations, and ranges of study variables.

Direct Effects of Parental Knowledge on Adolescent Alcohol Use Intentions and Frequency (RQ1)

Logistic regression estimates revealed that parental knowledge had a significant direct effect on adolescent alcohol use intentions [β (SE) = -0.12 (0.03), p=.033], such that adolescents who reported greater perceived parental knowledge at T1 had lower alcohol use intentions at T2 than those who reported lower levels of parental knowledge at T1. Similarly, results from the ordinal regression revealed that parental knowledge had a significant direct effect on alcohol use frequency [β (SE) = -0.19 (0.09), p=.010], such that adolescents who reported higher perceived parental knowledge at T1 had significantly lower rates of alcohol use frequency at T2 than those who reported lower

levels of parental knowledge at T1. Of the covariates, age had a significant direct effect on alcohol use intentions [β (SE) = 0.13 (0.04), p=.019] and frequency [β (SE) = 0.16 (0.19), p=.027], with older adolescents reporting greater alcohol use frequency and intentions as compared to their younger peers. Adolescents who were in the non-Hispanic other group reported lower alcohol use intentions [β (SE) = -0.12 (0.05), p=.005] as compared to those in the non-Hispanic White group. None of the other covariates had significant effects (see Table 2 for regression estimates).

Direct Effects of Parental Involvement on Adolescent Alcohol Use Intentions and Frequency (RQ2)

Logistic regression analyses revealed that there were no significant direct effects of parental involvement on adolescent alcohol use intentions [β (SE) = -0.06 (0.03), p=.288], but parental involvement was significantly associated with adolescent alcohol use frequency [β (SE) = -0.19 (0.11), p=.008], such that adolescents who reported higher perceived parental involvement at T1 had significantly lower alcohol use frequency at T2 as compared to those who reported lower perceived parental involvement. Of the covariates, age had a significant direct effect on alcohol use intentions [β (SE) = 0.15 (0.04), p=.011] and frequency [β (SE) = 0.18 (0.12), p=.014], with older adolescents reporting higher alcohol use intentions and frequency as compared to their younger peers. Adolescents who were in the non-Hispanic other group reported lower alcohol use intentions [β (SE) = -0.13 (0.06), p=.003], as compared to those in the non-Hispanic White group. None of the other covariates had significant effects (see Table 3 for regression estimates).

Direct and Indirect Effects of AWT, DD and AD on the Relationship between Parental Knowledge and Adolescent Alcohol Use Intentions and Frequency (RQ3)

Mediation analyses revealed that parental knowledge had a significant direct effect on adolescent AWT [β (SE) = -0.28 (0.02), p<.001], such that adolescents who reported higher perceived parental knowledge at T1 had significantly higher AWT tendencies at T2 than adolescents who reported lower perceived parental knowledge. Similarly, parental knowledge had significant direct effects on DD [β (SE) = -0.19 (2.35), p=.005] and AD [β (SE) = -0.21 (0.05), p=.001], such that adolescents who reported higher perceived parental knowledge at T1 had lower rates of DD and AD at T2 as compared to adolescents who reported lower perceived parental knowledge. AWT, in turn, had a significant effect on adolescent alcohol use intentions [β (SE) = 0.16 (0.10), p=.029], such that adolescents who reported higher AWT had significantly higher alcohol use intentions as compared to adolescents who reported lower AWT. There were no significant direct effects of DD [β (SE) = 0.04 (0.001), p=.519] or AD [β (SE) = 0.07 (0.05) p=.288] on alcohol use intentions.

The indirect effect of parental knowledge on alcohol use intentions through AWT was not significant at the p<.05 level [β (SE) = -0.04 (0.01), p=.058, 95% CI [-0.05, 0.00]]. When including AWT as a mediator, the direct effect of parental knowledge on alcohol use intentions became non-significant [β (SE) = -0.05 (0.03), p=.401]. The indirect effects of parental knowledge on adolescent alcohol use intentions through DD [β (SE) = -0.01 (0.01), p=.476, 95% CI [-0.02, 0.01]] and AD [β (SE) = -0.02 (0.01), p=.246, 95% CI [-0.02, 0.01]] were not significant.

There was a significant residual covariance between AWT and AD (r = .47, p<.001), hence, a covariance pathway was added to account for this residual covariance, which also improved the model fit. Model fit indices indicated a reasonable model fit, χ^2(df) = 10.48 (2.0), p=.005, CFI = 0.96, RMSEA = 0.11 (90% CI [0.052, 0.181]), p=.046, SRMR = 0.023 (see Figure 1 for regression estimates and model fit indices).

For the alcohol use frequency outcome, AWT had a significant direct effect on adolescent alcohol use frequency [β (SE) = 0.27 (0.31), p=.004], such that adolescents who reported higher AWT had significantly higher alcohol use frequency. There were no significant direct effects of of DD [β (SE) = -0.11 (0.003), p=.229] or AD [β (SE) = 0.01 (0.17), p=.894] on alcohol use frequency. The indirect effect of parental knowledge on alcohol use frequency through AWT was significant [β (SE) = -0.07 (0.04), p=.023, 95% CI [-0.18, -0.03]], such that adolescents who reported higher perceived parental knowledge at T1 had significantly lower rates of AWT and lower rates of alcohol use frequency at T2, with some of the effect of parental knowledge channeled through its negative association with AWT. When including AWT as a mediator, the direct effect of parental knowledge on alcohol use frequency became insignificant [β (SE) = -0.13 (0.11), p=.141]. A post hoc power analysis using MedPower (Kenny, 2018) with my sample size (N = 345) and direct/indirect model estimates revealed that this indirect effect is detected at a power of .998. Therefore, this significant indirect effect is likely a true effect rather than a result of a type 1 error. There were no significant indirect effects through DD [β (SE) = 0.02 (0.02), p=.219, 95% CI [-0.02, 0.07]] or AD [β (SE) = -0.003 (0.02), p=.891, 95% CI [-0.06, 0.05]].

There was a significant residual covariance between AWT and AD (r = .48, p<.001), hence, a covariance pathway was added to account for this covariance, which also improved the model fit. Model fit indices indicated a reasonable model fit χ^2(df) = 11.35 (2.0), p=.003, CFI = 0.94, RMSEA = 0.18 (90% CI [0.057, 0.186]), p=.034, SRMR = 0.021 (see Figure 2 for regression estimates and model fit indices).

Direct and Indirect Effects of AWT, DD, AD on Relationship Between Parental Involvement and Adolescent Alcohol Use Intentions and Frequency (RQ4)

Parental involvement had a signficiant direct effect on AWT [β (SE) = -0.13 (0.03), p=.028], such that adolescents who reported higher perceived parental involvement at T1 had significantly lower rates of AWT at T2. There were no significant direct effects of parental involvement on DD [β (SE) = -0.07 (2.60), p=.248] or AD [β (SE) = -0.10 (0.05), p=.070]. In turn, AWT was positively associated with alcohol use intentions [β (SE) = 0.17 (0.10), p=.016]. Accounting for the effect of AWT, DD [β (SE) = 0.06 (0.001), p=.364] and AD [β (SE) = 0.07 (0.05), p=.257] were not significantly associated with alcohol use intentions. There were no significant indirect effects of parental involvement on adolescent alcohol use intentions through AWT [β (SE) = -0.02 (0.01), p=.118, 95% CI [-0.03, 0.00]], DD [β (SE) = -0.004 (0.003), p=.380, 95% CI [-0.01, 0.00]], or AD [β (SE) = -0.01 (0.003), p=.129, 95% CI [-0.02, 0.00]].

There was a significant residual covariance between AWT and AD (r = .50, p<.001), hence, a covariance pathway was added to account for the residual covariance, which also improved the model fit. Model fit indices indicated a reasonable model fit, χ^2(df) = 13.31 (2.0), p=.001, CFI = 0.94, RMSEA = 0.13 (90% CI [0.069, 0.197]), p=.017, SRMR = 0.027 (see Figure 3 for regression estimates and model fit indices).

In the case of alcohol use frequency, AWT [β (SE) = 0.28 (0.31), p=.003] was significantly associated with alcohol use frequency, but DD [β (SE) = -0.09 (0.003), p=.340], and AD [β (SE) = 0.01 (0.17), p=.889] were not. Indirect effects of parental involvement on adolescent alcohol use frequency through AWT [β (SE) = -0.04 (0.03), p=.129, 95% CI [-0.13, 0.01]], DD [β (SE) = 0.01 (0.01), p=.503, 95% CI [-0.02, 0.04]], and AD [β (SE) = -0.001 (0.01), p=.836, 95% CI [-0.05, 0.04]] were not significant. There was a significant residual covariance between AWT and AD (r = .50, p<.001), hence a covariance pathway was added to the model, which also improved the model fit. Model fit indices indicated a reasonable model fit, χ^2(df) = 14.44 (2.0), p=.001, CFI = 0.90, RMSEA = 0.13 (90% CI [0.075, 0.203]), p=.012, SRMR = 0.025 (see Figure 4 for regression estimates and model fit indices).

CHAPTER IV

DISCUSSION

The purpose of the present study was to examine the direct and indirect effects of parental knowledge and parental involvement on adolescent alcohol use frequency and intentions as mediated by their associations with three distinct dimensions of impulsivity: AWT, DD, and AD. Previous research has documented direct parenting effects, such as attachment and relationship quality (Li et al., 2019; Pallini et al., 2018), parental monitoring, and parental involvement (Yap et al., 2017) on adolescent alcohol use, as well as indirect effects through self-control among adolescents (Wills et al., 2004) and emerging adults (Gibbs et al., 1998; Patock-Peckham & Morgan-Lopez, 2006). However, few studies have examined indirect effects of parental knowledge and involvement through adolescent self-control, and these too have been limited by the specific way in which self-control was operationalized (Akers & Sellers, 2004; Burt, 2020). Although research argues for using a more multifaceted view of impulse control (Whiteside & Lynam, 2001; Reynolds et al., 2008), there is a lack of studies that examine the unique mediating roles of distinct dimensions of impulsivity (AWT, DD, AD) in understanding the association between parenting behaviors and adolescent alcohol use. The present study addresses this gap by examining the direct and indirect effects of parental knowlege and involvement on early adolescent alcohol use intentions and frequency through AWT, DD, and AD as distinct dimensions of impulsivity. To the extent that impulsivity/self-control is malleable in early adolescent years, findings from this study can provide novel intervention targets, such as parenting-based interventions, that can directly promote adolescent self-control.

Overall, my results were consistent with the study hypotheses. Consistent with hypothesis one, I found that parental knowledge had direct protective effects for both adolescent alcohol use intentions and frequency. This is in line with prior findings from both cross-sectional (Bahr et al., 1998; Sellers et al., 2018) and longitudinal studies (Wang et al., 2013), showing that parental knowledge and associated positive relationship quality indicators, such as parent-adolescent attachment, can reduce the likelihood of alcohol use in adolescents (Elam et al., 2016; Yap et al., 2017). Parents who are more knowledgeable about their child's whereabouts are likely better able to limit opportunities for adolescents to engage in risk behaviors and reduce deviant peer influences (Dishion & McMahon, 1998; Dishion et al., 2004). Nevertheless, the extent to which adolescents self-disclose to their parents can vary based on the parent-adolescent relationship quality (Fletcher et al., 2004). Future studies should examine how other indicators of parent adolescent relationship quality, such as trust and support, predict adolescent alcohol use outcomes.

Significant protective effects of parental involvement were also observed in the case of adolescent alcohol use frequency but not for alcohol use intentions. Consistent with hypothesis two and previous research, parental involvement may directly decrease adolescent alcohol use frequency through limiting delinquent peer influence (Wood et al., 2004). Null results for the effect of parental involvement on adolescent alcohol use intentions point to differential effects of parenting behaviors on alcohol use outcomes (Tildesley & Andrews, 2008). It is possible that parental knowledge, through limiting opportunities for risk taking and deviant peer influence, may provide a stronger protective effect for alcohol use intentions as compared to parental involvement. Parental

knowledge may be associated with lower risk of being exposed to alcohol and therefore, decrease the likelihood that adolescents will think about drinking in the future. Previous studies have found differential effects of parenting dimensions (parental support, parental monitoring, inconsistent discipline) on adolescent alcohol use intentions, initiation, and frequency (Tildesley & Andrews, 2008; Weiss & Schwarz, 1996). Specifically, a longitudinal study found that lack of parental monitoring/knowledge was significantly associated with an increase in adolescent girls' alcohol use intentions, whereas inconsistent parental discipline (lack of enforcement of rules or structure) was significantly associated with an increase in alcohol use intentions for both boys' and girls' (Tildesley & Andrews, 2008).

Another possible reason for the null effect of parental involvement may be the measure used to assess parental involvement, which had a low reliability ($\alpha = 0.63$). Additionally, the measurement of parental involvement may vary based on ethnocultural and socioeconomic factors which may not have been adequately captured by the current measure. Given that around 30% of the current study's sample self-identified as Hispanic, it is possible that the current parental involvement measure did not adequately capture ethnocultural parenting practices that may be uniquely protective of adolescent alcohol use in diverse communities. Similarly, there could be variations in parenting behaviors based on socioeconomic differences. Low-income families typically have less opportunities to monitor or be involved in their adolescents' lives due to a variety of reasons, including single parent households (Blum et al., 2000), working multiple jobs, and lack of financial resources (Griffin et al., 2000; Spijerkaman et al., 2008). Neighborhood risk and lack of good role models can also impact parenting behaviors and

their effects on adolescent alcohol use (Griffin et al., 2000). Future research should examine effects of different parenting behaviors using stronger measures that are sensitive to ethnocultural and socioeconomic variations.

Consistent with hypothesis three, there was evidence of indirect effects, with the effect of parental knowledge on adolescent alcohol use frequency being fully mediated by AWT; however after accounting for the effect of AWT, DD and AD were not significant mediators. Although parental knowledge was associated with all three impulsivity dimensions, only AWT was a significant mediator of parental knowledge effects on alcohol use frequency. Controlling for the effect of AWT, DD and AD were not significantly associated with adolescent alcohol use outcomes (intentions, frequency). These findings suggest that the association of parental knowledge with lower adolescent alcohol use may be explained through adolescents' ability to use top-down processes to better regulate their impulses. Prior studies have found that specific parenting behaviors (e.g., harsh, controlling parenting) can influence the development of self-control in early to middle childhood (Kiff et al., 2011); however, less is known about how parenting behaviors may impact impulsive action in adolescence. It may be that parents who have more information about their adolescent's life and behaviors as well as a trusting parent-adolescent relationship, can model self-regulation for their children and create an environment that reduces opportunities for risk taking (Chen & Jacobson, 2013). Parents who provide support and supervision may create the external control necessary to shape an adolescents' ability to gradually internalize that control and inhibit impulsive acts through learning and practicing (Henry et al., 1996; Lynam et al., 2000; Menting et al.,

2016). Supportive and consistent parenting may be especially important for adolescents who display early weaknesses in behavioral regulation (Matthys et al., 2012).

Additionally, genetic factors (Gartstein et al., 2013; Niv et al., 2012) and epigenetic influences (Bridgett et al., 2015) may also explain the observed association between parental knowledge and adolescent AWT. Specifically, the COMT gene in charge of coding proteins related to serotonin and dopamine as well as other neurotransmitters, has been identified as playing an influential role in impulse control development, including the maturation of AWT (Kreek et al., 2005). Along with genes, heritability of biological indicators may influence both the development of impulsivity dimensions as well as alcohol use (Lejuez et al., 2010). Therefore, the intergenerational transmission of genetic and biological factors may explain the significant results found for the mediating effect of AWT on the relationship between parental knowledge and adolescent alcohol use frequency. Future studies should specifically examine how genetic, epigentic, and biological factors operate together in understanding how parental factors influence adolescent impulsivity and alcohol use. Although this mediating effect was significant for adolescent alcohol use frequency, the indirect effect through AWT on adolescent alcohol use intentions was not significant at the $p<.05$ level.

Inconsistent with hypothesis four, there were no significant indirect effects of AWT, DD, or AD as parallel mediators on the relationship between parental involvement and adolescent alcohol use intentions or frequency. This is inconsistent with prior work that has found a negative association between parental involvement and AWT (Khurana et al., 2015b). Parents who actively spend time with their children have opportunities to model impulse control regulation and provide support for emotion regulation

development (Pallini et al., 2018) through scaffolding (Geier et al., 2010), autonomy support (Chang et al., 2015; Lengua et al., 2014), and opportunities for practicing self-control behaviors (Li et al., 2019). The lack of significant indirect effects in the current study may be related to the limitations of the 3-item measure used to assess parental involvement. This measure may not have been comprehensive or sensitive in measuring different aspects of parental involvement, specifically those aspects (such as autonomy support) that are more likely to predict impulsivity (Chang et al., 2015; Lengua et al., 2014). Prior studies that have found significant effects of parental involvement on child self-control have used different measures for parental involvement including emotional closeness, parental supervision (Goncy & van Dulmen, 2010; Schoppe-Sullivan et al., 2004), parent's modeling of self-control, practicing and providing opportunities for their children to use impulse control, instilling values, and using positive parenting practices that can positively impact the development of self-control (Li et al., 2019). Thus, it seems likely that the null findings observed in the present study may be due to the limitations of the measure including low reliability ($\alpha = 0.63$). Future research should examine the indirect effects of parental involvement using more comprehensive and reliable measures, including observational data.

Both DD and AD did not significantly mediate the relationship between parental factors (parental knowledge, parental involvement) and adolescent alcohol use outcomes (alcohol use intentions, alcohol use frequency) when accounting for all impulsivity dimensions in parallel mediation models. Although DD is reflective of deficits in top-down control, it captures impulsive choice instead of impulsive action (Khurana & Romer, 2019). It is possible that parental knowledge and involvement have differential

effects on impulsive action vs. impulsive choice. As previous research has found, DD is not as sensitive to individual differences, such as parental impacts, during early to mid adolescence (Romer 2010; van den Bos et al., 2015; Wilson & Daly, 2006). DD trajectories are found to have a monotonic decline with age, suggesting a stronger role of maturation in explaining differences in DD as compared to AWT (Romer et al., 2017). It is nevertheless possible that environmental influences like parenting do influence DD by teaching children how to persist through difficult tasks (e.g., academics) in pursuit of long term goals (Li et al., 2019; Roth et al., 2009); however, these parenting behaviors may have an earlier effect on DD and less so during adolescence. Another rationale for the null mediation findings of DD may be the way in which DD was measured. Although behavioral tasks using similar monetary prompts and response choices to Green and colleagues (1994) are widely used to measure DD (Shulman et al., 2016), adolescent responses may vary due to socioeconomic status. Research has found that low-income individuals experience increased difficulties with future-oriented thinking and DD due to increased stress, decreased monetary resources, and necessity to ultilize resources once they becomes available (Bickel et al., 2014; Reimers et al., 2009). The measure used in the current study to examine DD utilized monetary-oriented prompts and response choices. Given that over half of the current sample self-reported low-income status through free or reduced lunch eligibility, their responses on the DD task may have been biased. Future studies should test this association using non-monetary behavioral measures of DD.

Similarly, AD also requires top-down control in order to focus attention on a particular task. Attentional control abilities, as measured by speed and accuracy of an

attention network test, significantly improve from ages 6 to 9 years old (Rueda et al., 2004) with growth occurring from ages 4 to 6 (Rueda et al., 2005). However, when examining middle childhood to adulthood, there was greater stability in aspects of attention, including alerting, orienting, and executive control (Rueda et al., 2004). Consistent with this finding, one study modeling trajectories of working memory from early to mid-adolescence, found that working memory (which correlates strongly with attention control) remained relatively stable across 4 years (Khurana et al., 2012). Therefore, it is possible that there is less variability in attentional control during adolescence (Rueda et al., 2004) and as such AD may not be as responsive to environmental influences, such as parenting behaviors, during later years. Another possible explanation for the null finding may be related to the low reliability of the AD measure ($\alpha = 0.61$). Finally, it is important to note that DD and AD were not significant mediators when accounting for the other components of impulsivity (i.e., AWT) within the same model. DD and AD could operate as independent mediators when examined in separate models.

Limitations

The current study has the following limitations. Measurement of parental knowledge and involvement through adolescent self-report alone may not be an accurate representation of parental influences. Previous studies have utilized direct observation, self-reports from parents (Dishion & McMahon, 1998; Locke & Prinz, 2002) or multi-informant reports of parenting practices from both parent and adolescent perspectives (Achenbach et al., 1987; Hunsley & Mash, 2007). As noted previously, the parental involvement measure used in the current study included only 3 items, which is not as

comprehensive as the 8 item parental knowledge measure, and this may explain why we found stronger effects for parental knowledge than parental involvement. Further, the parental involvement measure may not have captured specific aspects of parental involvement that are expected to influence impulse control (e.g., autonomy support).

Measures of AWT, DD, AD, alcohol use intentions, and alcohol use frequency were also based on adolescent self-report. Although studies have found that self-report measures of impulsivity (including AWT, DD, and AD) are reliable and valid (Shulman et al., 2016; Weiser & Reynolds, 2011), lab-based tasks can provide more objective assessments of underlying abilities. Relatedly, the measurement of DD in the current study relied on a hypothetical situation posed to participants that may not capture ways in which parenting behaviors can affect DD (e.g., modeling and teaching persistence through difficult tasks). Additionally, adolescent participants may under- or overreport history of engagement in alcohol use or alcohol use frequency.

Peers can be an important social context to consider when predicting adolescent alcohol use (Leung et al., 2014). Although parental knowledge of peer groups and parental involvement can decrease the likelihood of negative peer influence (McCann et al., 2019), peer drinking norms can influence adolescent alcohol use intentitions and behaviors, and should be an important covariate to include in future investigations.

Finally, the current analyses utilized two time points of data, collected 6 months apart, which prevents testing of a time-ordered mediation model (Cole & Maxwell, 2003). Due to the nature of the data, T1 variables predicted T2 outcomes and not change over time. Future studies should use larger, more representative samples with longitudinal designs, multi-informant data of the parent-adolescent relationship, and more

comprehensive measures of parental constructs and impulsivity/self-control (Jo & Armstrong, 2018). Future longitudinal research should also explore how specific parenting practices during adolescence can impact individuals with early deficits in impulse control, who may be most at-risk for progressive and problematic alcohol use (Bjork & Pardini, 2015).

Implications

The current study advances our understanding of the direct and indirect effects of parental inputs (parental knowledge, parental involvement) on adolescent alcohol use intentions and frequency through three constructs of impulsivity (AWT, DD, AD). Early to mid adolescence is a critical developmental period to examine these relationships as this is the developmental stage in which alcohol use onset typically begins and parents can play a key role as socializing agents in influencing adolescents' self-control abilities and alcohol use behaviors. The differential effects of impulsivity dimensions (AWT, DD, AD) as mediators of the relationship between parental inputs (knowledge, involvement) and adolescent alcohol use (intentions, frequency) provide further support for examining impulsivity as a multi-dimensional construct.

Further, findings from the current study suggest that AWT may be uniquely sensitive to parenting effects, as compared to other impulsivity dimensions, which helps to identify a promising avenue for early intervention and prevention. Findings from this study highlight how parental knowledge can serve as a protective factor for reducing adolescent alcohol use frequency through its negative association with AWT. The finding related to full mediation of parental knowledge effects on adolescent alcohol use frequency through AWT has important clinical implications. This finding shows that any

influence that parental knowledge had on alcohol use in current sample was channeled through parental effects on AWT, with no direct influence of parental knowledge on early alcohol use. AWT plays a salient role in predicting alcohol use during this developmental period (Khurana et al., 2013), and is a critical target for prevention efforts. Interventions that strengthen adolescents ability to exert impulse control can be especially effective in reducing drinking behaviors among younger adolescents (Collado et al., 2014; Pandey et al., 2018). Present findings suggest that including a parenting component to existing interventions that target adolescent impulse control could help boost their impact (Latendresse et al., 2007; Mason et al., 2016; Pandey et al., 2018).

There is scant but promising evidence from parenting interventions on reducing adolescent substance use through strengthening adolescent self-control (Fosco et al., 2013). Parenting-based interventions that focus on positive discipline, communication, monitoring skills (Lamb & Crano, 2014; Siegel et al., 2015; Vermeulen-Smit et al., 2015), modeling problem solving behaviors (Kochanska et al., 2000), and encouraging persistence while solving difficult tasks (Steinberg et al., 1992) may have greater success in strengthening self-control (Carver & Scheier, 2000; Wills et al., 2004). A recent systematic review and meta analysis examined the effectiveness of child and adolescent interventions aimed to strengthen self-regulation and prevent substance use (Pandey et al., 2018). Findings provide support for curriculum-based interventions implemented by teachers in classrooms, family-based interventions involving parents and siblings, mindfulness techniques (Harris et al., 2017) and yoga (Butzer et al., 2017) interventions across all child and adolescent age groups (Pandey et al., 2018). The Family Check-Up, an evidence-based family intervention, has also been successful in aiding parents in

strengthening their child's self-regulation as well as reducing substance use (Fosco et al., 2013; Stormshak et al., 2010).

Specific to AWT, a newer prevention program, the Preventure Programme (Conrad, 2016), uses components of Cognitive Behavioral Therapy to increase youth's awareness and identification of high-risk situations in order to strengthen impulse control, prevent impulsive action (AWT), and delay early substance use onset (Conrad et al., 2010). However, this program utilizes manuals administered in school settings by trained facilitators and clinical settings by mental health specialists but does not include parents as critical socializing agents. Some executive function training programs that include parent coaching components have shown promising evidence in reducing externalizing problems, such as substance use, in middle childhood and adolescent samples (Karbach & Unger, 2014; Tamm & Nakonezny, 2015; Vassileva & Conrad, 2019). However, more research is needed to understand how components of parenting interventions specifically impact AWT and subsequent adolescent alcohol use (Vassileva & Conrad, 2019).

Conclusion

The present study supports previous research indicating direct influences of parental knowledge and involvement on adolescent alcohol use intentions and frequency. Although parental influences on adolescent substance use have been well established and some studies have found significant mediating effects of self-control/impulsivity, scant research has examined how parents can impact adolescent alcohol use through specific dimensions of impulsivity (AWT, DD, AD). The present study found a significant mediating effect of AWT on the relationship between parental knowledge and adolescent alcohol use frequency. This finding highlights the importance of understanding how

parenting behaviors can reduce risk for adolescent substance use, specifically through strengthening impulse control abilities and decreasing impulsive action. These results provide support for identifying and developing parenting-based interventions that facilitate adolescent impulse control development to reduce risk for adolescent alcohol use.

APPENDICES

APPENDIX A

Table 1

Means, Standard Deviations, Ranges, and Correlations for Study Variables

Variables	1	2	3	4	5	6	7	8	9	10	11	12
1. PK	-											
2. PI	.42***	-										
3. AWT	-.26***	-.14*	-									
4. DD	-.15**	-.05	.16**	-								
5. AD	-.17**	-.10	.54***	.17**	-							
6. AI	-.17**	-.08	.25***	.09	.20**	-						
7. AF	.19**	.16**	-.25***	.05	-.14*	-.70***	-					
8. Age	-.13*	-.07	-.01	.01	-.01	.16**	-.18**	-				
9. Female	.15**	.06	-.17**	-.12*	-.09	-.08	.06	-	-			
10. Hisp	-.06	.06	-.14*	.03	-.09	-.01	.02	-	-	-		
11. Other	.06	-.02	.04	-.12*	.03	-.14*	.09	-	-	-	-	-
12. SES	-.12*	-.06	.01	-.09	.01	.03	-.01	-	-	-	-	-
M	2.87	1.96	0.43	39.07	2.81	-	-	12.65	-	-	-	-
SD	0.83	0.71	0.30	28.84	0.60	-	-	0.67	-	-	-	-
Range	0-4	0-3	0-1	10-100	1-5	0-1	0-2	12-14	0-1	0-1	0-1	0-1

Note. PK=Parental Knowledge; PI=Parental Involvement; AWT=Acting Without Thinking; DD=Delay Discounting; AD=Attentional Control Difficulties; AI=Alcohol Use Intentions; AF=Alcohol Use Frequency; Hisp=Hispanic; Other=Non-Hispanic Other SES=Socioeconomic Status as measured by eligibility for Free or Reduced Lunch.

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

APPENDIX B

Table 2

Unstandardized and Standardized Regression Estimates for Parental Knowledge Predicting Adolescent Alcohol Use Intentions and Alcohol Use Frequency

Outcome	Variable	Regression Estimates		
		B (SE)	*β*	*p*
AI				
	Parental Knowledge	**-0.06 (0.03)**	**-0.12**	**.033**
	Age	**0.09 (0.04)**	**0.13**	**.019**
	Female	-0.05 (0.05)	-0.06	.305
	Hispanic	-0.04 (0.05)	-0.04	.482
	Non-Hispanic Other	**-0.16 (0.05)**	**-0.12**	**.005**
	SES	0.01 (0.05)	0.02	.764
AF				
	Parental Knowledge	**-0.24 (0.09)**	**-0.19**	**.010**
	Age	**0.26 (0.19)**	**0.16**	**.027**
	Female	-0.06 (0.15)	-0.03	.691
	Hispanic	-0.14 (0.17)	-0.06	.411
	Non-Hispanic Other	-0.44 (0.25)	-0.14	.082
	SES	-0.02 (0.16)	-0.01	.894

Note. Bolded pathways indicate statistical significance $p < .05$. AI=Alcohol Use Intentions; AF=Alcohol Use Frequency; SES=Socioeconomic Status as measured by eligibility for Free or Reduced Lunch

APPENDIX C

Table 3

Unstandardized and Standardized Regression Estimates for Parental Involvement Predicting Adolescent Alcohol Use Intentions and Alcohol Use Frequency

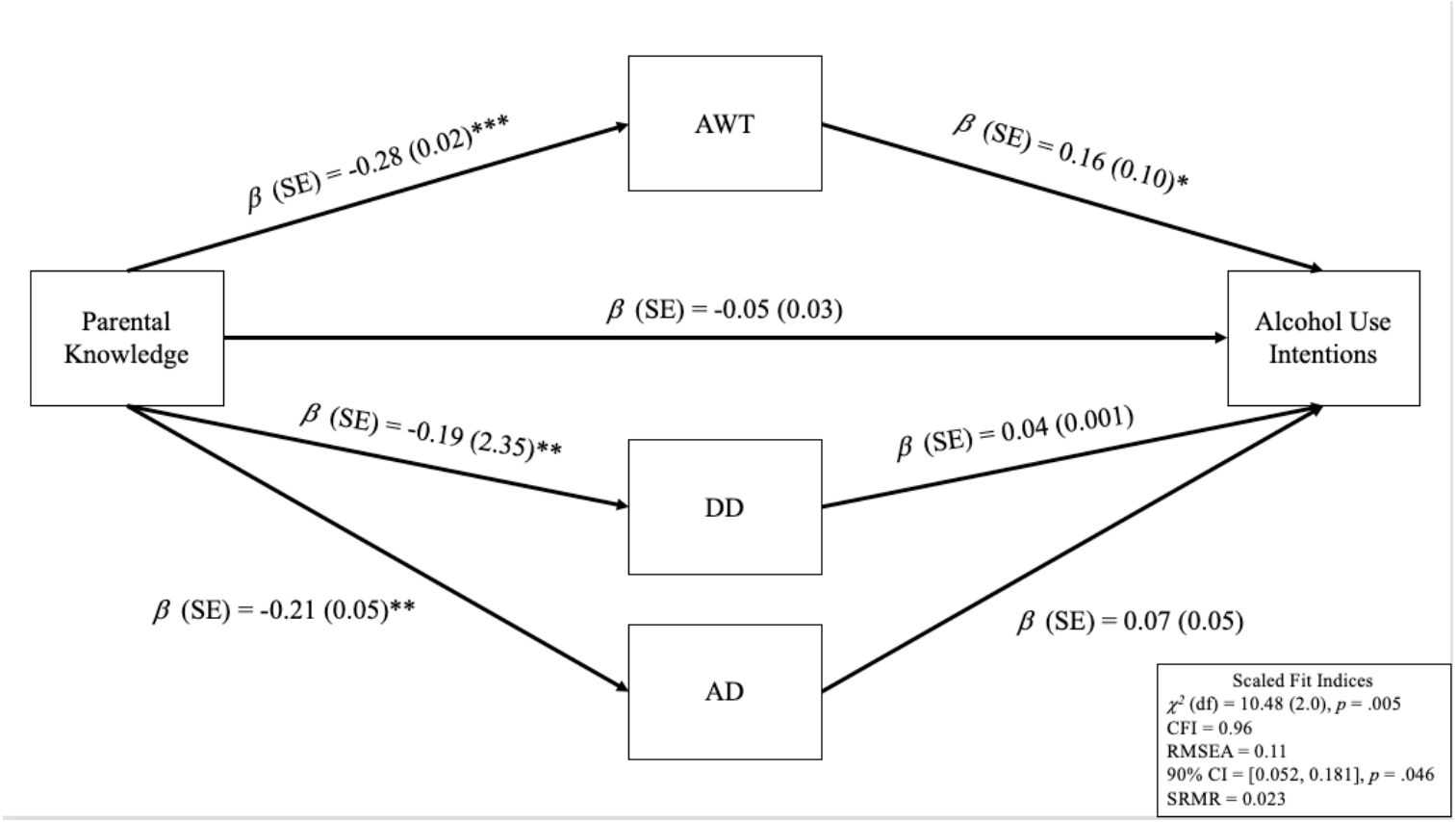
Outcome	Variable	Regression Estimates		
		B (SE)	*β*	*p*
AI				
	Parental Involvement	-0.03 (0.03)	-0.06	.288
	Age	**0.09 (0.04)**	**0.15**	**.011**
	Female	-0.06 (0.05)	-0.07	.211
	Hispanic	-0.03 (0.05)	-0.01	.930
	Non-Hispanic Other	**-0.16 (0.06)**	**-0.13**	**.003**
	Free or Reduced Lunch	0.02 (0.05)	0.02	.672
AF				
	Parental Involvement	**-0.29 (0.11)**	**-0.19**	**.008**
	Age	**0.29 (0.12)**	**0.18**	**.014**
	Female	-0.09 (0.15)	-0.04	.546
	Hispanic	-0.11 (0.17)	-0.05	.529
	Non-Hispanic Other	-0.48 (0.25)	-0.15	.056
	Free or Reduced Lunch	-0.01 (0.16)	-0.01	.935

Note. Bolded pathways indicate statistical significance $p < .05$. AI=Alcohol Use Intentions; AF=Alcohol Use Frequency; SES=Socioeconomic Status as measured by eligibility for Free or Reduced Lunch

APPENDIX D

Figure 1

Direct and Indirect Effects of Parental Knowledge on Adolescent Alcohol Use Intentions



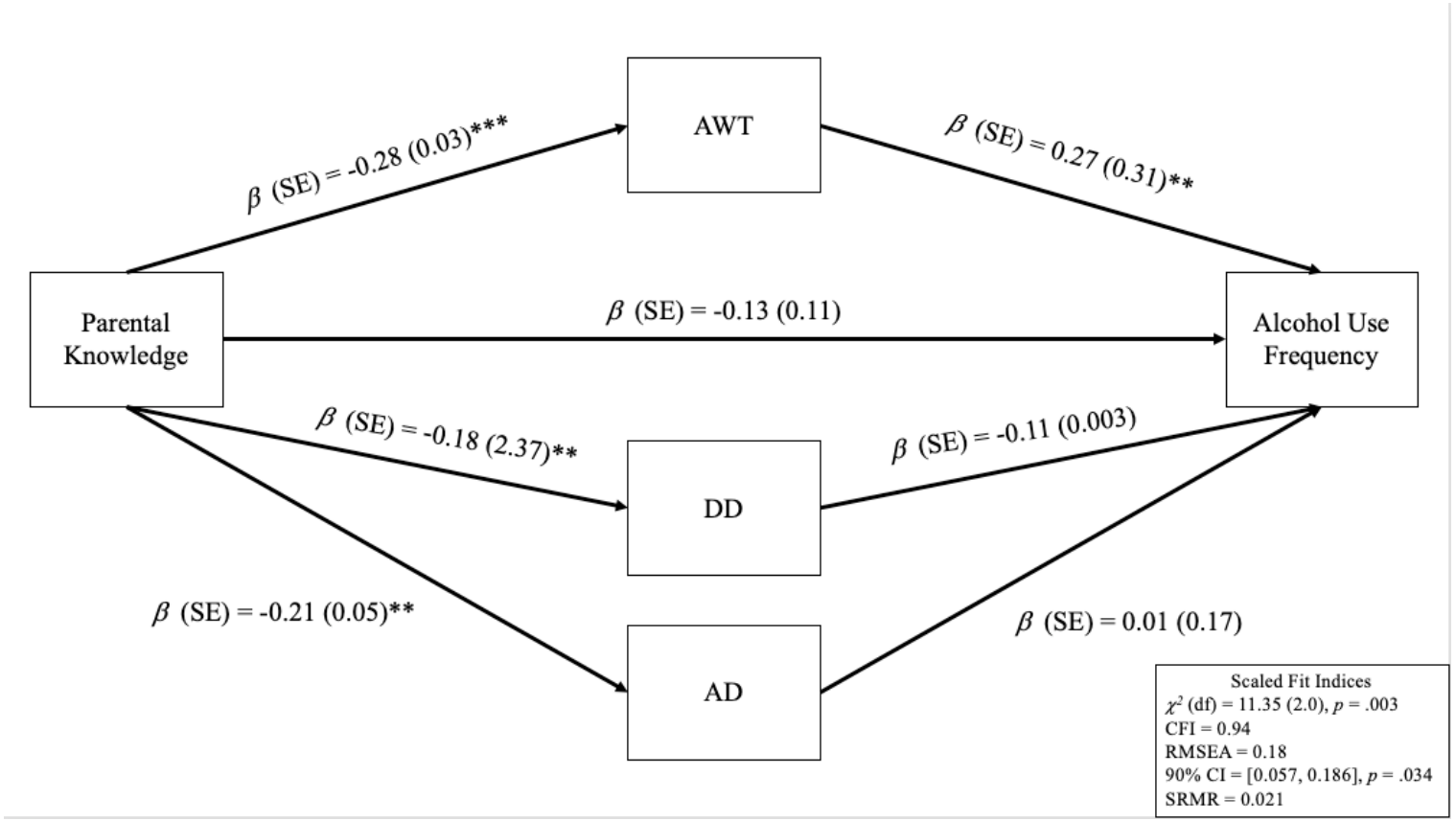
Note. Model included covariates of age, female, Hispanic, non-Hispanic other, and socioeconomic status. Residual covariance between Acting without thinking and attentional control difficulties was modeled. AWT=Acting Without Thinking, DD=Delay Discounting, AD=Attentional Control Difficulties. Scaled fit indices are reported.

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

APPENDIX E

Figure 2

Direct and Indirect Effects of Parental Knowledge on Adolescent Alcohol Use Frequency



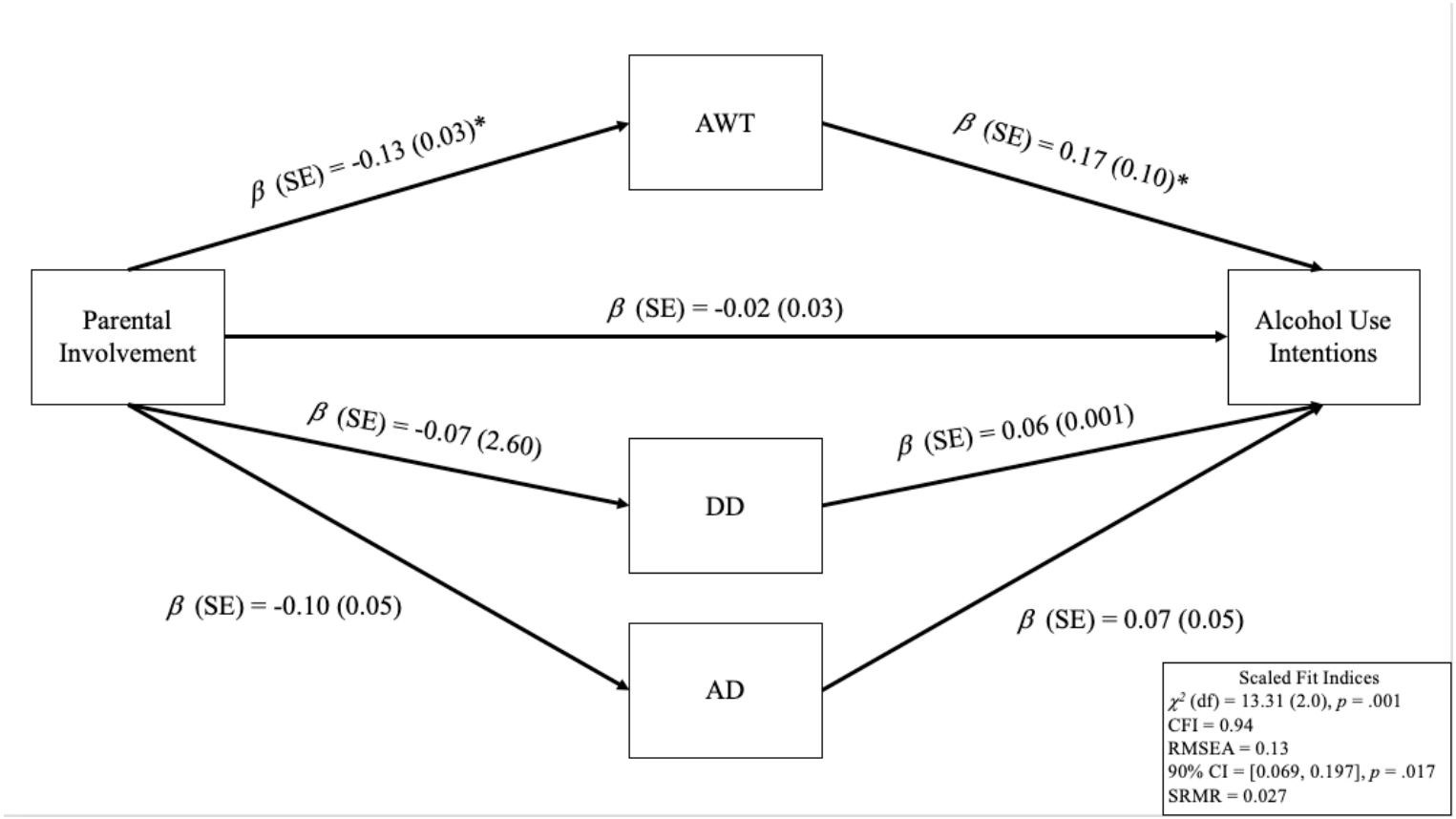
Note. Model included covariates of age, female, Hispanic, non-Hispanic other, and socioeconomic status. Residual covariance between Acting without thinking and attentional control difficulties was modeled. AWT=Acting Without Thinking, DD=Delay Discounting, AD=Attentional Control Difficulties. Scaled fit indices are reported.

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

APPENDIX F

Figure 3

Direct and Indirect Effects of Parental Involvement on Adolescent Alcohol Use Intentions



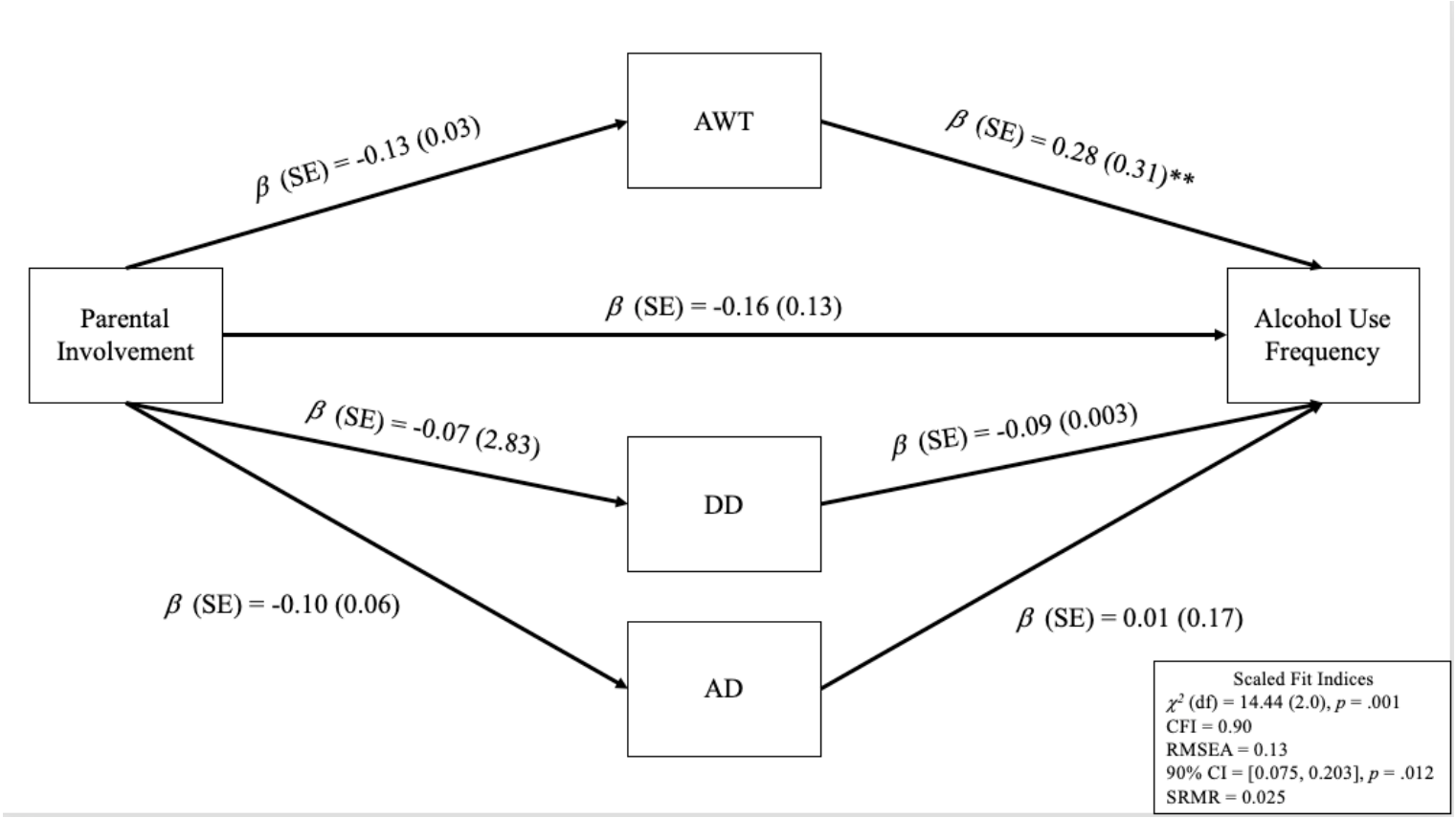
Note. Model included covariates of age, female, Hispanic, non-Hispanic other, and socioeconomic status. Residual covariance between Acting without thinking and attentional control difficulties was modeled. AWT=Acting Without Thinking, DD=Delay Discounting, AD=Attentional Control Difficulties. Scaled fit indices are reported.

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

APPENDIX G

Figure 4

Direct and Indirect Effects of Parental Involvement on Adolescent Alcohol Use Frequency



Note. Model included covariates of age, female, Hispanic, non-Hispanic other, and socioeconomic status. Residual covariance between Acting without thinking and attentional control difficulties was modeled. AWT=Acting Without Thinking, DD=Delay Discounting, AD=Attentional Control Difficulties. Scaled fit indices are reported.

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

APPENDIX H

PARENTAL MONITORING SCALE

On a scale of 1-5 (Never to always), how often do your parents know….[Randomize order]

Question	Never 1	Rarely 2	Sometimes 3	A lot of the time 4	Always 5
What you do during your free time?	1	2	3	4	5
Who you have as friends?	1	2	3	4	5
What type of homework you have?	1	2	3	4	5
What you spend your money on?	1	2	3	4	5
When you have an exam or paper due at school?	1	2	3	4	5
How you do in different subjects at school?	1	2	3	4	5
Where you go when you are out with friends at night?	1	2	3	4	5
Where you go and what you do after school?	1	2	3	4	5

APPENDIX I

ROTHBART'S EARLY ADOLESCENT TEMPERAMENT QUESTIONNAIRE

EFFORTFUL CONTROL MEASURE

In the following section I will read a series of statements that people might use to describe themselves. The statements refer to a wide number of activities and attitudes. For each statement, please tell me the answer that best describes how true each statement is **for you.** There are no best answers. People are very different in how they feel about these statements. Please tell me the first answer that comes to you.

How true is each statement for you?	Almost always untrue	Usually untrue	Sometimes true, sometimes untrue	Usually true	Almost always true
It is easy for me to really concentrate on homework problems.	1	2	3	4	5
When interrupted or distracted, I forget what I was about to say.	1	2	3	4	5
I find it hard to shift gears when I go from one class to another at school.	1	2	3	4	5
When trying to study, I have difficulty tuning out background noise and concentrating.	1	2	3	4	5
I am good at keeping track of several different things that are happening around me.	1	2	3	4	5
I tend to get in the middle of one thing, then go off and do something else.	1	2	3	4	5
I pay close attention when someone tells me how to do something.	1	2	3	4	5

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