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Domain-Specific Impulsivity in School-Age Children

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Abstract

Impulsivity is a salient individual difference in children with well-established predictive validity for life outcomes. The current investigation proposes that impulsive behaviors vary systematically by domain. In a series of studies with ethnically and socioeconomically diverse samples of middle school students, we find that schoolwork-related and interpersonal-related impulsivity, as observed by teachers, parents, and the students themselves, are distinct, moderately correlated behavioral tendencies. Each demonstrates differentiated relationships with dimensions of childhood temperament, Big Five personality factors, and outcomes, such as sociometric popularity, report card grades, and classroom conduct. Implications for theoretical conceptions of impulsivity as well as for practical applications (e.g., domain-specific interventions) are discussed.

Keywords

impulsivity; self-control; domain-specificity; academic achievement

Impulsivity is an individual difference of timeless and timely significance. Defined as the inability to regulate behavior, attention, and emotions in the service of valued goals, impulsivity¹—and its obverse, self-control—has held a central role in conceptions of socialization and development at least since Freud (1922). Two decades earlier, in a series of lectures entitled *Talks to Teachers*, James (1899) posited that the question of how conflicting goals were reconciled—the “compounding of our impulses with our inhibitions”—was of central importance for both theoretical and pedagogical reasons (p. 178). The ability to regulate oneself, with decreasing reliance on others to enforce behavioral standards, is now widely recognized as a foundational skill for a wide array of developmental processes (Eisenberg et al., 2004; Kochanska, Murray, & Harlan, 2000; Mischel, Shoda, & Rodriguez, 1989). In the past decade, research on self-control has bloomed, not only in developmental psychology, which has witnessed a five-fold increase in articles on the topic (Carlson, 2011), but also in psychology broadly (Duckworth & Kern, 2011). In parallel, popular interest in the importance of self-control for success in life has surged (Baumeister & Tierney, 2011; Lehrer, 2009; Mischel & Brooks, 2011; PBS, 2011).

Conspicuously absent from the burgeoning literature on impulsivity and self-control is any serious investigation of how impulsive behaviors in children might vary systematically by domain. The omission is unfortunate but not surprising. Contemporary temperament and personality research tends to focus on individual differences that are relatively stable across time and kinds of situations (Mischel, 2004). To an extent, viewing individual differences

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¹The terms *impulsivity* and *self-control* are used differently by different authors (Duckworth & Kern, 2011). Our definition of the term self-control corresponds to Rothbart and Rueda’s (2005) and Eisenberg et al.’s (2004) concept *effortful control* and emphasizes the volitional, effortful performance of subdominant responses rather than dominant, immediately rewarding responses in order to achieve long-term reward.

through a domain-general lens is justified: It is true, important, and interesting that some children are generally more impulsive than others. On the other hand, it seems equally plausible, important, and interesting that, for instance, some children particularly struggle with controlling their temper, while others are especially prone to daydreaming during class.

Mischel and colleagues have argued persuasively against considering situation-specific variance in behavior as merely noise or error that obscures domain-general differences in personality (Mischel, Shoda, & Mendoza-Denton, 2002). Instead, distinctive situation-behavior profiles constitute an important locus of consistency in personality. For instance, in the classroom doing quiet work, a child may be consistently self-controlled, but in social situations involving interpersonal conflict, she may be more impulsive. As Bandura (1999) has pointed out, “Given the highly conditional nature of human functioning, it is unrealistic to expect personality measures cast in nonconditional generalities to shed much light on the contribution of personal factors to psychosocial functioning in different task domains under diverse circumstances across all situations” (p. 12).

Domain-Specific Impulsivity in Children

In contrast to a relatively impoverished literature on domain-specificity in impulsive behaviors, there have been numerous efforts to identify the underlying psychological processes that collectively give rise to impulsive behaviors. At least a dozen multi-dimensional models of impulsivity have been proposed (see Duckworth & Kern, 2011). For instance, Barratt and colleagues (Patton, Stanford, & Barratt, 1995) have identified attentional, motor, and nonplanning processes relevant to impulsivity in adults. Similarly, Zuckerman (1994) identified thrill and adventure seeking, experience seeking, disinhibition, and boredom susceptibility processes. Whiteside and Lynam (2001) executed the most systematic of these efforts, administering several previously published impulsivity questionnaires to a common sample of undergraduates. Factor analyses produced four distinct factors corresponding to “discrete psychological processes that lead to impulsive-like behaviors” (Whiteside & Lynam, 2001, p. 685): the inability to override strong urges; the tendency to act before thinking; the inability to focus on boring or difficult tasks; and sensation seeking, defined as attraction to exciting and risky activities. Buss and Plomin (1975) identified nearly identical dimensions in children (i.e., inhibitory control, decision time, persistence, and sensation seeking).

Domains are not the same as processes. Domains refer to situational contexts, whereas processes are internal. One can imagine how more than one process could be relevant to behavior in a given domain. For instance, regulating behavior in the social context may require a child to override strong emotions like anger and, in addition, to stop and think about the consequences before saying what is on his mind. Likewise, a common process may affect behavior in different domains. For example, regulating behavior in school may also require overriding strong urges (e.g., to procrastinate) and thinking before acting (e.g., thinking about what needs to be taken to school before leaving home). Thus, insights into the processes that give rise to impulsive behaviors do not directly lead to predictions about how impulsive behavior may vary systematically by domain.

In our review of the developmental literature, we found only one investigation of domain-specific impulsivity in children: Humphrey (1982) asked fourth and fifth grade teachers to rate their students on 15 different impulsive behaviors. Factor analyses suggested two related ($r = .61$) but distinct factors, labeled by Humphrey as “cognitive/personal” and “behavioral/interpersonal” behaviors. Items Humphrey considered impulsive cognitive acts included “fails to complete assignments when the adult is not watching” and “is distracted from work or responsibilities”; examples of interpersonal impulsivity included “gets into

arguments and/or fights with other children” and “talks out of turn.” Two more recent studies provide further support for this distinction. In a study on teaching ratings of classroom behavior, Alexander, Entwisle, and Dauber (1993) suggested distinct factors for “Attention Span-Restlessness” and “Cooperation-Compliance” (and also “Interest-Participation”). Similarly, in a study on teacher and parent ratings of temperament, Caspi, Henry, McGee, Moffitt, and Silva (1995) identified separate factors labeled “Distractability” and “Irritability” (as well as “Approach” and “Sluggishness”).

Development of a Domain-Specific Impulsivity Scale for Children

In light of these prior studies, our major hypothesis in the current investigation is that for school-age children, impulsive behavior in the social context is related to, yet distinct from, the impulsive behavior in the schoolwork context. To test this hypothesis, we developed a novel questionnaire called the Impulsivity Scale for Children (ISC). In addition to developing a scale that could be used as both a domain-specific and a general measure (by averaging subscales), five design objectives guided our efforts. First, unlike Humphrey (1982), we aimed to identify specific behaviors nominated by school-age children themselves as indicating lapses in self-control. In doing so, we would avoid projecting our own preconceived (and possibly inaccurate) notions about behaviors that entailed a subjective struggle to overcome short-term temptation in exchange for long-term gain. This atheoretic, bottom-up approach relies on descriptors nominated by individuals other than the researcher (Church, 2001). Second, we sought to include behaviors of sufficient frequency and consequence for overall functioning to warrant measurement. Third, we sought to create parallel student-, parent-, and teacher-report scales with conceptually similar items. Fourth, we wanted a brief scale so that participants—especially teachers reporting on many students—would not be overburdened.

Finally, to avoid reference group bias—the tendency to use one’s particular reference group to evaluate oneself when responding to self-report questionnaires (Heine, Lehman, Peng, & Greenholtz, 2002)—we wanted to design a response scale with objectively-defined frequency anchors. Most questionnaires employed in psychological research use Likert-type response categories such as “very true,” “often,” and “about average.” However, the interpretation of such categories can vary widely among individuals. For example, wide disparities in intuitive interpretations of frequency categories have been documented among college students (Porter, 2009). Asked to describe how often they engaged in various activities using standard categories (i.e., “never,” “occasionally,” “often,” or “very often”), undergraduates were later asked the same question by indicating the number of times they had engaged in the activity. Among students who described themselves as “often” in asking others to read something they wrote, 18% specified “once or twice a year,” 33% specified “3 to 6 times a year,” and 35% specified “1 to 2 times a month” (Pace & Friedlander, 1982, p. 271). When respondents randomly vary in how they respond, measurement error increases. An even more pernicious problem emerges when there is systematic bias in how response categories are interpreted by respondents, which can lead to biased, not just underpowered, estimates of associations with other variables. Given these concerns, we worked with the same panel of teachers who assisted in item selection to create response categories that specified objective, discrete periods.

Current Investigation

In the current investigation, we sought evidence for distinct domains of impulsivity in school-age children across three separate studies of middle school students. In Study 1, in the fall semester, students completed the ISC, rating the frequency with which they engaged in specific impulsive behaviors. Separately, their teachers completed an informant-version

of the same scale. To compare the predictive validity of domain-specific subscales, school records were collected at the end of the academic year. To replicate and extend these findings, in Study 2, parents of middle school children were recruited online to complete the informant-report version of the ISC. In Study 3, students, teachers, and parents completed the ISC in the fall, and school records were collected at the end of the academic year. In all studies, we examined the factor structure of the ISC as well as evidence for convergent and discriminant validity of identified subscales. Likewise, in all three studies, we compared the predictive validity of domain-specific subscales for relevant outcomes.

Study 1

In Study 1, we administered student- and teacher-report versions of the ISC at two urban middle schools. We first conducted exploratory factor analyses to ascertain the subscales. Next, we examined convergent validity with the Brief Self-Control Scale (Tangney, Baumeister, & Boone, 2004), a widely-used domain-general self-control scale, and discriminant validity with IQ. Finally, we examined the predictive validity of the subscales with GPA, predicting that schoolwork impulsivity would be a better predictor than interpersonal impulsivity. In addition, we hypothesized that schoolwork impulsivity would be a better predictor of *changes* in GPA over the school year.

Method

Participants—Participants were fifth through seventh grade students at two public schools in Philadelphia. About 83% of the 561 students chose to participate. Participants were not significantly different from non-participants in terms of gender, race, age at assessment, or household income. Of the 464 consented students, 11 were omitted from analyses because both teachers and students did not complete the study measures (final $N = 453$, mean age = 12.5 years, $SD = 1.2$). About 94% were Black, 4% of participants were Latino, and 2% were other ethnicities; 51% were female. The median estimated household income was \$30,349 ($SD = \$14,181$).

Procedure and Measures—Students and teachers completed consent forms and questionnaires during the fall semester. For each student, two teachers completed informant ratings of impulsivity and self-control. At the conclusion of the school year, outcome data were collected from school records.

Domain-Specific Impulsivity: Following Buss and Craik (1983), we solicited anonymous open-ended responses from several hundred public and private middle school children about behaviors that exemplified self-control or failures thereof in their own lives. The resultant list of 414 nominated behaviors was reviewed by a panel of seven public and private middle school teachers, who rated each behavior, using a 3-point frequency scale where 1 = *Very common and very important to overall functioning*, 2 = *Either very common but unimportant or very rare but important*, and 3 = *Not common and not important*. We averaged these ratings, and retained the top 62 items (15%; cutoff of 1.33).² We then reduced the number of items to 28 by paraphrasing and merging conceptually similar items. Finally, we selected items and adjusted language to create student, teacher, and parent versions that were as closely matched on content as possible. Ultimately, we retained eight items (see Table 1). With input from the teachers, we identified five frequency levels designed to be intuitively meaningful and also to allow for maximal distribution in observed

²While it would be ideal to analyze all of these items empirically, we felt that the quality of the data may have suffered given that 62 items would be tedious for the children and impractical for the teachers (who rated multiple students) to complete.

student behavior: 1 = *almost never*, 2 = *about once per month*, 3 = *about 2 to 3 times per month*, 4 = *about once per week*, and 5 = *at least once per day*.

Students completed the ISC. Teachers completed a teacher-report version, which included items starting with “This student...” instead of “I...” Internal reliability coefficients for the ISC and its subscales ranged from .63 to .95 (avg. = .86; see Table 1).

Domain-General Self-control: Students completed the Brief Self-Control Scale (Tangney, et al., 2004), a 13-item questionnaire that includes self-control items endorsed on a 5-point Likert scale, where 1 = *not like me at all* and 5 = *very much like me* (e.g., “I am good at resisting temptation”). Teachers completed an informant version. Observed internal reliability coefficients were .75, .97, and .96, for the student and teachers’ ratings, respectively.

IQ: Students completed Raven’s Progressive Matrices (Raven, 1948), a widely-used test of nonverbal intelligence. The test comprises 60 matrices, each of which has one element missing. The task in each case is to select correctly the piece that completes the pattern from a set of alternatives. Children were given as much time to finish as they needed; all finished within 45 minutes. Because standardized scores are not available for Raven’s Progressive Matrices, we regressed raw scores on participant age and saved the standardized residuals, which we then used as an age-corrected intelligence score.

GPA: We collected course grades from school records. We calculated GPA for each marking period (quarters for one school and trimesters for the other) and for final GPA by averaging grades from all major academic courses, including math, science, language arts, and social studies classes.

Socioeconomic Status and Demographic Variables: We obtained data on gender, ethnicity, birthdate, and home addresses from school records. Using home addresses in conjunction with U.S. Census bureau data, we estimated the median household income by census block for each participant.

Results and Discussion

Exploratory Factor Analysis—Exploratory factor analyses (EFAs) produced coherent *interpersonal impulsivity* and *schoolwork impulsivity* factors. We conducted separate EFAs for the student and teacher versions of the ISC. We used the squared multiple correlation method to compute prior communality estimates and set the minimum factor loading criterion to .40 (Floyd & Widaman, 1995). Because we expected domains of self-control to share common components and therefore to be correlated, we used oblique promax rotation ($k = 4$). To determine the number of factors to extract, we used parallel analyses (Horn, 1965), scree tests (Cattell, 1966), the minimum average partial criterion (Velicer, 1976), Bartlett’s chi-square test (Geweke & Singleton, 1980), and the Kaiser criterion (Kaiser, 1960). These tests suggested extracting 1 to 4 factors (average = 2). We selected the two-factor solution because it was psychologically meaningful and consistent across student and teacher items.³ As shown in Table 1, the four-item subscales for schoolwork and interpersonal impulsivity demonstrated adequate internal consistency, $\alpha = .63$ to $.95$, avg. = .86. The schoolwork and interpersonal factor correlations were $r = .60$, $.47$, and $.40$ for the

³We conducted confirmatory factor analyses and confirmed that the two-factor solution fit the data better than the one-factor solution, $p < .001$. We also examined three-factor exploratory factor models, but only one item loaded by itself on the third factor for the self-report EFA and none of the items loaded on the third factor for the teacher EFAs.

student- and teacher versions of the scale, respectively, suggesting that these domains are moderately to strongly correlated.

Composite Scores—To increase reliability and minimize multicollinearity in subsequent analyses, we followed best practice in psychology by creating composite scores from the student- and teacher-report ratings (Eid & Diener, 2006). Associations among ratings were generally moderate to large for interpersonal impulsivity (avg. $r = .47$, $ps < .001$), schoolwork impulsivity (avg. $r = .31$, $ps < .05$), and general impulsivity (8-item ISC; avg. $r = .41$, $ps < .001$), as well as self-control, avg. $r = .44$, $ps < .001$. These associations compare favorably to the meta-analytically derived average correlation of $r = .22$ between child self-report and informant ratings and $r = .28$ between two different types of informant (e.g., parent/teacher) by Achenbach, McConaughy, and Howell (1987). Following Nunnally (1978), we found the reliability of these composites ranged from .93 to .97.

Convergent and Discriminant Validity—The ISC and its subscales demonstrated convergent validity with the Brief Self-Control Scale, $rs = -.72$ to $-.88$, $ps < .001$. To test discriminant validity, we examined correlations between the ISC and its subscales and IQ, $rs = -.11$ to $-.15$, $ps < .05$. While significant, these correlations were small in magnitude. Following procedures outlined by Meng, Rosenthal, and Rubin (1992), we confirmed that correlations between measures of impulsivity and self-control were significantly stronger than corresponding correlations between measures of impulsivity and IQ, $ps < .001$.

Domain-Specific Associations—To compare the predictive validities of interpersonal and schoolwork impulsivity, we fit a simultaneous multiple regression model predicting GPA. As predicted, schoolwork impulsivity ($\beta = -.59$, $p < .001$) was a better predictor of GPA than interpersonal impulsivity ($\beta = -.06$, $p = .17$), $p < .001$ for the difference in β s. In other words, while schoolwork impulsivity was a robust predictor of GPA, interpersonal impulsivity did not predict GPA holding schoolwork impulsivity constant. We also fit a simultaneous multiple regression model predicting final marking period GPA from both interpersonal and schoolwork impulsivity as well as first marking period GPA. This allowed us to examine the variance uniquely accounted for by each type of impulsivity in *changes* in the outcomes over time. As predicted, schoolwork impulsivity predicted decreases in GPA over the school year ($\beta = -.18$, $p < .001$), but interpersonal impulsivity ($\beta = .03$, $p = .42$) did not, $p = .003$ for the difference in β s. These results were practically identical when controlling for IQ.

Study 2

Study 1 provided initial evidence for the validity of the student and teacher versions of the ISC. In Study 2, we administered a parent-report version. We conducted exploratory factor analyses, then examined convergent validity with two self-control scales: the Brief Self-Control Scale used in Study 1 and a more widely used child behavior scale, the Social Skills Rating System. Study 1 used IQ to examine discriminant validity with impulsivity, but it could be argued that a more relevant test would compare ratings of impulsivity with ratings on another trait rather than an objective performance measure, such as IQ. Consequently, we asked parents to rate openness to experience for discriminant validity. Finally, in addition to GPA, we assessed hours studying and watching television as behavioral outcomes of impulsivity (Duckworth & Seligman, 2005). We predicted that schoolwork impulsivity, compared to interpersonal impulsivity, would be a better predictor of GPA, hours studying, and hours watching television.

Method

Participants—Participants were 166 parents of fourth through eighth grade students. We recruited and paid participants \$0.75 through Amazon.com's Mechanical Turk (MTurk), a crowdsourcing website where requesters can hire workers to complete tasks (Buhrmester, Kwang, & Gosling, 2011). About 84% of participants were White, 7% were Black, 4% were Asian, 2% were Hispanic, and 3% were other ethnicities; 63% were female.

Measures and Procedure

Domain-Specific Impulsivity: Parents completed a parent-report version of the ISC. Each item started with "My child..." instead of "I..." Internal reliability coefficients for the ISC and its subscales ranged from .77 to .85 (avg. = .81; see Table 1).

Self-control: Parents completed a parent-report version of the Brief Self-Control Scale (Tangney, et al., 2004) described in Study 1. The observed internal reliability was .87.

Parents also completed select items from the Social Skills Rating System (SSRS; Gresham & Elliot, 1990). Our own factor analyses as well as independent research on separate samples (Whiteside, McCarthy, & Miller, 2007) failed to replicate the original published factor structure of the SSRS. Therefore, we used 9 face-valid self-control items (e.g., "Controls temper in conflict situations," "Attends to your instructions") from the parent version of the SSRS, which in prior published studies has demonstrated strong convergent validity with other questionnaire measures of self-control as well as predictive validity for theoretically relevant outcomes (Duckworth, Kim, & Tsukayama, in prep; Duckworth, Quinn, & Tsukayama, in press; Tsukayama, Toomey, Faith, & Duckworth, 2010). The observed internal reliability of the 9-items used was .70.

Openness to Experience: Parents completed a parent-report version of the Openness to Experience subscale of the Big Five Inventory (BFI; John & Srivastava, 1999). Parents endorsed items (e.g., "My child is curious about many different things") using a 5-point Likert-type scale, where 1 = *not like me at all* and 5 = *very much like me*. The observed internal reliability was .84.

GPA, Hours Studying, and Hours Watching TV: Parents were asked "Which of the following statements best describes your child's grades on his/her last report card?" where 1 = *Mostly A's* to 8 = *Mostly below D*. We also asked "About how many hours per day does your child spend on the computer, watching TV or playing video games?" and "About how many hours per day does your child spend studying?"

Results and Discussion

Exploratory Factor Analysis—Using the same methods described in Study 1, we conducted an EFA on the parent-report version of the ISC. Factor extraction tests suggested a two-factor solution that was consistent with the models in Study 1 (see Table 1). The factor correlation was $r = .65$.

Convergent and Discriminant Validity—The ISC and its subscales demonstrated convergent validity with the Brief Self-Control Scale, $r_s = -.60$ to $-.71$, $p_s < .001$, as well as the Social Skills Rating System, $r_s = -.50$ to $-.62$, $p_s < .001$. To test discriminant validity, we examined correlations between openness to experience and the ISC and its subscales ($r_s = -.22$ to $-.31$, $p < .001$), the Brief Self-Control Scale ($r = .40$, $p < .001$), and the Social Skills Rating System ($r = .37$, $p < .001$). Correlations among impulsivity/self-control

measures were significantly higher than correlations between measures of impulsivity/self-control and openness to experience, $ps < .001$.

Domain-Specific Associations—To compare the predictive validities of interpersonal and schoolwork impulsivity, we fit simultaneous multiple regression models predicting each outcome. As predicted, schoolwork impulsivity, but not interpersonal impulsivity, predicted GPA ($\beta = -.31, p < .01$), hours studying ($\beta = -.16, p < .05$), and hours watching TV ($\beta = .20, p < .01$). However, due to the relatively small sample size ($N = 166$), the differences in predictive validity were not always significant, indicating that schoolwork impulsivity was not necessarily a significantly stronger predictor than interpersonal impulsivity (see Table 3). Nonetheless, these results indicate that schoolwork impulsivity, but not interpersonal impulsivity, predicts unique variance in GPA, hours studying, and hours watching TV.

Study 3

Studies 1 and 2 provided preliminary support for the validity of the ISC. However, we see two limitations of these studies. First, student-, teacher-, and parent versions were not simultaneously examined in the same sample. While we assume that ratings from the three sources would converge, this could not be empirically tested. Second, the two studies were not ethnically diverse—participants in Study 1 were predominantly Black (94%), while participants in Study 2 were predominantly White (84%). A more comprehensive study would include a diverse sample. Therefore in Study 3, we replicated and extended our findings with an ethnically and socioeconomically diverse sample of public and private school students as well as their teachers and parents. Furthermore, we assessed childhood temperament and the Big Five personality taxonomy in order to locate the constructs of interpersonal and schoolwork impulsivity within a nomological network (Cronbach & Meehl, 1955).

After conducting Confirmatory Factor Analyses (CFAs) to test the two-factor structure found in Studies 1 and 2, we assessed convergent validity with a domain-general measure of self-control and discriminant validity with IQ. Finally, we examined the relationships among schoolwork and interpersonal impulsivity and dimensions of temperament, personality, and school outcomes. Formally, we predicted that interpersonal impulsivity would be a better predictor of aggression, frustration, surgency, agreeableness, extraversion, neuroticism, and popularity, whereas schoolwork impulsivity would be a better predictor of activation control, attention, conscientiousness, openness to experience, and GPA. We did not have strong predictions for conduct grades since they were based on both homework completion and classroom conduct. Among the dimensions of temperament, we predicted that aggression would be the best predictor of interpersonal impulsivity, whereas activation control and/or attention would be the best predictor/s of schoolwork impulsivity. Similarly, among the Big Five traits, we predicted that agreeableness would be the best (inverse) predictor of interpersonal impulsivity, whereas conscientiousness would be the best predictor of schoolwork impulsivity. Finally, in addition to being a better predictor of final GPA, we hypothesized that schoolwork impulsivity would be a better predictor of *changes* in GPA over the school year.

Method

Participants—Participants were fifth through eighth grade students at one private and two public middle schools in New York. About 92% of the 835 students chose to participate. Participants were not significantly different from non-participants in terms of gender, race, age at assessment, or household income. Of the 772 consented students, 60 were omitted from analyses because both parents and students did not complete the study measures (final $N = 712$, mean age = 11.9 years, $SD = 1.3$). About 45% of participants were Latino, 26%

were Black, 23% were White, 3% were Asian, and 3% were other races; 53% were female. The median estimated household income for this sample was \$28,611 ($SD = \$38,877$).

Procedure and Measures—Participants completed measures during the fall semester. Students and teachers completed the questionnaires on site at their respective schools. Parents completed hard-copy or online questionnaires. At the conclusion of the school year, outcome data were collected from school records.

Domain-Specific Impulsivity: Students, teachers, and parents completed respective versions of the ISC. Associations among ratings were generally moderate for interpersonal impulsivity (avg. $r = .31$, $ps < .001$), schoolwork impulsivity (avg. $r = .28$, $ps < .001$), and general impulsivity (8-item ISC; avg. $r = .31$, $ps < .001$). Internal reliability coefficients for the ISC and its subscales ranged from .63 to .91 (avg. = .81; see Table 2). We created composite scores by averaging the student-, teacher-, and parent-report ratings. The internal reliability of these composite were .88, .86, and .92 for interpersonal impulsivity, schoolwork impulsivity, and (8-item) ISC respectively.

Domain-general self-control: Parents and teachers rated participants on a single item, “How self-controlled is this child?” using a 7-point scale where 1 = *very low in self-control* and 7 = *very high in self-control*. Parent and teacher ratings of domain-general self-control were correlated at $r = .32$, $p < .001$. We averaged these scores to create a composite measure of self-control.

IQ: Students completed the same measure of IQ—Raven’s Progress Matrices (Raven, 1948)—used in Study 1.

Temperament: Students and parents completed subscales of theoretical relevance to self-control from the Early Adolescent Temperament Questionnaire-Revised Short Form (Putnam, Ellis, & Rothbart, 2001). Specifically, we administered *activation control* (e.g., “I finish my homework before the due date”), *attention* (e.g., “I pay close attention when someone tells me how to do something”), *aggression* (e.g., “I tend to be rude to people I don’t like”), *frustration* (e.g., “I get irritated when I have to stop doing something that I am enjoying”), and *urgency* (e.g., “I sometimes like doing things that are a bit frightening”). Observed internal reliabilities ranged from .53 to .80 for student ratings and .58 to .65 for parent ratings of students. Student and parent ratings for each temperament dimension were correlated, avg. $r = .24$, $ps < .05$. We averaged student and parent ratings to create composite scores. The internal reliability of these composites ranged from .81 to .89 (avg. = .86).

Big Five personality: Students and teachers completed the Big Five Inventory (John & Srivastava, 1999), a widely used 44-item measure of the Big Five personality traits. Students endorsed items (e.g., “I see myself as someone who is full of energy”) using a 5-point Likert-type scale, where 1 = *not like me at all* and 5 = *very much like me*. Observed internal reliabilities of the BFI subscales measuring open mindedness, conscientiousness, extraversion, agreeableness, and neuroticism ranged from .70 to .73 for student ratings and .85 to .94 for teacher ratings of students. We created composite measures for each of the Big Five dimensions by averaging teacher- and self-report ratings. Correlations between student and teacher ratings on each of the Big Five ratings averaged $r = .27$, $ps < .05$. The internal reliability of these composite ranged from .80 to .91 (avg. = .87).

Popularity: Students completed questionnaires in which they responded to the following prompt: “We are interested in peer relationships among children your age. Among the classmates *in your grade and at this school*, list the three friends that you hang out with the

most. The order in which you list these friends does not matter. If you feel like you really only hang out with one or two friends, just list their names. If you feel like you hang out with four or more, just pick three for this list.” We computed a student’s popularity by counting the number of times s/he appeared on other students’ lists of friends.

GPA: We collected final course grades from school records. We calculated GPA for each quarter and for final GPA by averaging grades from all major academic courses, including math, science, language arts, and social studies classes.

Conduct grades: As part of regular school practice, teachers at both public schools rated student homework and conduct in each class using a single 5-point scale, where 1 = *unsatisfactory*, 2 = *needs improvement*, 3 = *satisfactory*, 4 = *good*, and 5 = *excellent*. We calculated conduct for each marking period and for final conduct by averaging grades from all major academic courses, including math, science, language arts, and social studies classes.

Socioeconomic Status and Demographic Variables: We obtained data on gender, ethnicity, birthdate, and home addresses from school records. Using home addresses in conjunction with U.S. Census bureau data, we estimated the median household income by census block for each participant.

Results and Discussion

Confirmatory Factor Analysis—Separate CFAs on the student, parent, and teacher-report ISC items confirmed that domain-specific two-factor models fit the data better than domain-general one-factor models, $p_s < .001$ (see Table 2). In the two-factor models, items were allowed to load freely on their respective factor, the factor loadings with other factors were set to zero, and the covariance between the factors was freely estimated. In the one-factor models, all items were allowed to load freely on a single factor. Factors were scaled by setting the variance equal to 1.0. All factor loadings were significant at $p < .001$.

The hypothesized two-factor models fit the data adequately (see Table 2). Following recommendations suggested by Kline (2004), we considered CFI values greater than .90, RMSEA values less than .10, and SRMR values less than .10 to indicate acceptable fit. All CFI estimates were .90 and all SRMR estimates were .07. The RMSEA for student- and parent-report versions of the scale were .097 and .089, respectively. However, the RMSEA for the teacher-report model was .162.⁴ Although the RMSEA was greater than expected, this indication of poor fit may have resulted from small model size (Kenny & McCoach, 2003), and large factor loadings (Browne, MacCallum, Kim, Andersen, & Glaser, 2002; Miles & Shevlin, 2007), rather than actual model misspecification.

Finally, we tested for measurement invariance across gender, age, and school type by estimating multiple-group CFA models and constraining the factor loadings to be equal across groups (i.e., males vs. females, median-split younger vs. older students, and private vs. public schools). Using CFI .91 as a guideline (see Cheung & Rensvold, 2002), we found that the same factor structure held across gender (CFIs .91) and age (CFIs .905). While the factor structure appeared to hold across school type for students (CFI = .902) and parents (CFI = .91), it may have differed for teachers (CFIs = .913).

⁴Allowing the item “This student interrupted other students in discussion” to load on both factors, allowing its error to covary with “This student’s mind wandered when he or she should have been listening,” and allowing the error for “This student did not remember what his or her teacher told him or her to do” to co-vary with the error for “This student’s mind wandered when he or she should have been listening” reduced the RMSEA to .085.

Convergent and Discriminant Validity: The ISC and its subscales demonstrated convergent validity with domain-general self-control, $r_s = -.60$ to $-.70$, $p_s < .001$. In support of discriminant validity, correlations between the ISC subscales and IQ ($r_s = -.18$ to $-.23$, $p_s < .001$) were significantly weaker, $p_s < .001$ for the difference in r_s .

Domain-Specific Associations: To compare the predictive validities of interpersonal and schoolwork impulsivity, we fit simultaneous multiple regression models predicting each outcome. Because popularity was a count variable (i.e., non-negative integers) and non-normally distributed, we conducted regression analysis with a generalized linear model (GzLM), specifying a negative binomial reference distribution and log link (Hardin & Hilbe, 2003). To facilitate interpretation of incidence rate ratios (IRRs), we standardized predictors prior to model estimation. Finally, we compared the predictive validity of the different dimensions of childhood temperament and the Big Five personality traits on interpersonal and schoolwork impulsivity in separate models for each set and outcome (e.g., Big Five predicting interpersonal impulsivity).

As shown in Table 3, in general alignment with our predictions, schoolwork and interpersonal impulsivity were differentially related to dimensions of temperament, Big Five personality traits, and school outcomes. Interpersonal impulsivity was more strongly related to aggression ($\beta = .51$, $p < .001$), frustration ($\beta = .26$, $p < .001$), surgency ($\beta = .19$, $p < .001$), extraversion ($\beta = .37$, $p < .001$), agreeableness ($\beta = -.59$, $p < .001$), and neuroticism ($\beta = .32$, $p < .001$), $p_s < .05$ for the differences in β s. On the other hand, schoolwork impulsivity was more strongly related to activation control ($\beta = -.38$, $p < .001$), attention ($\beta = -.35$, $p < .001$), openness ($\beta = -.21$, $p < .001$), conscientiousness ($\beta = -.68$, $p < .001$), and GPA ($\beta = -.46$, $p < .001$), $p_s < .01$ for the differences in β s. Contrary to prediction, however, popularity was not more strongly associated with interpersonal impulsivity ($\beta = .02$, $p = .72$) than with schoolwork impulsivity ($\beta = -.12$, $p = .063$), $p = .25$ for the difference in β s. While their zero-order correlations with popularity were significant ($p_s < .05$), neither interpersonal nor schoolwork impulsivity were significant predictors in the generalized linear model. Both interpersonal ($\beta = -.30$, $p < .001$) and schoolwork impulsivity ($\beta = -.42$, $p < .001$) were associated with conduct.

As predicted, aggression ($\beta = .39$, $p < .001$) was the best predictor of interpersonal impulsivity compared to the other dimensions of temperament, $p_s < .001$ for the difference in β s. While activation control ($\beta = -.26$, $p < .001$) and attention ($\beta = -.22$, $p < .001$) were the best predictors of schoolwork impulsivity ($p < .05$ for most of the difference in β s), attention did not explain significantly more variance than frustration ($\beta = .14$, $p < .001$), $p = .15$ for the difference in absolute β s. Among the Big Five personality factors, agreeableness was the best predictor ($\beta = -.49$, $p < .001$) of interpersonal impulsivity ($p_s < .001$ for the difference in β s), whereas conscientiousness was the best predictor ($\beta = -.70$, $p < .001$) of schoolwork impulsivity, $p_s < .001$ for the difference in β s.

To compare the predictive validities of each type of impulsivity for changes in GPA and conduct, we fit simultaneous multiple regression models controlling for initial levels of outcomes and including both interpersonal and schoolwork impulsivity as predictors. As predicted, schoolwork impulsivity predicted decreases in GPA over the school year ($\beta = -.16$, $p < .001$), but interpersonal impulsivity ($\beta = -.03$, $p = .47$) did not, $p = .05$ for the differences in β s. Schoolwork ($\beta = -.13$, $p = .005$) and interpersonal impulsivity ($\beta = -.11$, $p = .01$) each accounted for comparable variance in changes in classroom conduct over the course of the school year, $p = .69$ for the differences in β s. These results were practically identical when controlling for IQ.

General Discussion

Casual observation suggests that children who reliably resist certain kinds of temptations can be quite impulsive about others. The present study provides empirical support for domain-specific impulsivity in school-age children and suggests that the interpersonal and schoolwork domains are of particular relevance during this developmental period. Impulsive behaviors in both domains appear to contribute to teachers' and parents' domain-general impressions of self-control. However, factor analyses of student, teacher, and parent inventories of impulsive behaviors indicated that behaviors cluster within these two domains. Moreover, as theoretically predicted, whereas interpersonal impulsivity was most strongly related (inversely) to agreeableness, schoolwork impulsivity was most strongly related (inversely) to conscientiousness. Similarly, whereas the temperament dimension of aggression was most strongly related to interpersonal impulsivity, activation control and attention were most strongly related (inversely) to schoolwork impulsivity.

As predicted, schoolwork-related lapses in self-control (e.g., allowing one's mind to wander) played a more important role than interpersonal impulsivity (e.g., interrupting others) in predicting academic performance. Specifically, schoolwork impulsivity, but not interpersonal impulsivity, predicted fewer hours spent studying and more hours spent watching television. Furthermore, schoolwork impulsivity, but not interpersonal impulsivity, predicted decreases in GPA over the course of the school year when assessing the effects of both predictors. Both types of impulsivity predicted decreases in teacher ratings of classroom conduct over the school year, suggesting that interpersonal impulsivity gives rise to consequential problems for school-age children, even if it does not dramatically influence report card grades.

Finally, the ISC accomplished our five design goals: (1) the items are behaviors nominated by the children themselves as indicating lapses in self-control, (2) the items reflect common and consequential behaviors, (3) we created parallel student-, parent-, and teacher-report scales, (4) we developed a brief scale to minimize the burden on participants, and (5) we designed a response scale with objectively-defined frequency anchors. In combination, these five design features should increase the usefulness of this questionnaire not only for research purposes but also for formative assessment (i.e., providing useful feedback for identifying improvement goals).

Theoretical Implications

Our findings are consistent with extensive research demonstrating the validity of two distinct dimensions of ADHD (Willcutt et al., in press), with interpersonal impulsivity corresponding to the hyperactivity-impulsivity symptoms of ADHD (e.g., "Often interrupts or intrudes on others") and schoolwork impulsivity corresponding to the inattention symptoms (e.g., "Often has difficulty sustaining attention in tasks or play activities"). However, it is important to note that the hyperactivity dimension of ADHD also includes symptoms unrelated to interpersonal impulsivity, such as "Is often 'on the go' or acts as if 'driven by a motor'" (American Psychiatric Association, 2000). Nonetheless, given that taxometric analyses (Haslam et al., 2006) suggest ADHD represents the low-end of the impulsivity spectrum (i.e., a difference in degree rather than kind from non-clinical impulsivity), the well-established findings supporting the validity of the two-dimension model of ADHD also corroborate our results.

Our proposition that impulsive behaviors vary according to context (i.e., domain specificity) is nevertheless compatible with the observation that such behaviors are also correlated across different situations (i.e., domain generality). Stability across situations suggests

common processes are involved; systematic variance across situations suggests that domain-specific processes are *also* relevant.

Why do impulsive behaviors cluster by domain? We see at least three possible explanations, each with distinct theoretical implications. First, there may be separate psychological (and presumably neurobiological) processes that are involved in the regulation of schoolwork and interpersonal behavior. Most of the schoolwork-related impulsive behaviors on our scale imply dysregulation of *attention* in some way, whereas most of the interpersonal-related impulsive behaviors suggest dysregulation of *emotion*. Thus, it may be that what varies across domains is the kind of impulse and, in turn, the corresponding regulatory system.

A second possibility is that what varies by domain may be the motivation to control impulses. To the extent that the subjectively perceived harmful *consequences* of impulsive behaviors vary by domain, so, too, should the expressed behavior. For instance, some children may care more (or less) about report card grades and other academic outcomes than about their social relationships. Finally, it is possible that what varies by domain is impulse strength. Oscar Wilde once quipped, “I can resist everything but temptation.” Put another way, impulses which rage strongly in one child may be quiet in another. This account suggests that a child who loses his temper but not his homework may experience stronger urges when arguing with other people than when sitting down to study. Similarly, some children may be more intrinsically interested in what their teachers are saying, dampening, in effect, the lure of goofing off, daydreaming, and so on.

Consistent with this third account of domain-specificity in impulsive behavior, a recent review of neuroimaging studies suggests that prefrontal brain regions supporting self-control are domain-general, whereas the subcortical regions representing impulses (i.e., “the reward, salience, and emotional value of a stimulus”) vary depending on the domain (Heatherton & Wagner, 2011, p. 134). In addition, Tsukayama and colleagues (2012) found in several studies of adults that about 40% of within-individual variance in impulsive behavior across domains was explained by the degree to which specific impulsive behaviors were “tempting” (i.e. enjoyable and desired) after controlling for ratings of perceptions of harm. Contrariwise, perceptions of the harm associated with the same impulsive behaviors explained only 2% of within-individual variance in impulsive behavior after controlling for ratings of impulse strength.

Practical implications

Many children who act impulsively in the interpersonal domain are more self-controlled in the schoolwork domain and vice-versa. To illustrate this possibility, we categorized participants into thirds (high, medium, and low) based on their schoolwork and interpersonal impulsivity scores. As shown in Table 4, roughly half of the participants fell along the diagonal (i.e., high, medium, or low in both types of impulsivity). For the remaining half, scores for schoolwork and interpersonal impulsivity diverged. We see two important practical implications of domain specificity in impulsivity among school-age children. First, teachers providing feedback to students and parents about behavioral competencies and challenges should distinguish between types of impulsive behavior. The ISC, developed in close collaboration with both private and public school teachers, could be a useful tool for both formative assessment and screening for targeted intervention. Second, direct interventions aimed at reducing impulsive behavior among children might be tailored to address domain-specific problems. Strategies that help students avoid distractions to their academic work (e.g., Duckworth, Grant, Loew, Oettingen, & Gollwitzer, 2011) may differ substantially from those that help students keep their tempers in check (e.g., Kross, Duckworth, Ayduk, Tsukayama, & Mischel, 2011).

Although we focused on the domain-specific aspects of the ISC in this investigation, it should be noted that it can be used as both a domain-specific measure and by summing subscale scores of impulsive behavior in school-age children. Indeed, the ISC has already been employed in several studies (e.g., Duckworth, et al., in prep; Duckworth, et al., in press; Suchodoletz, Larsen, Faesche, & Gunzenhauser, in prep; Wu, Duckworth, Kim, & Chen, in prep).

Limitations and Future Directions

To our knowledge, this study is the first to investigate domain-specific impulsivity in school-age children. Like any empirical effort, this study's limitations suggest profitable directions for future work. First, while the samples we used were collectively socioeconomically and ethnically diverse, replication studies, ideally with nationally representative samples (and, indeed, in non-US countries) are needed to confirm the degree to which our findings generalize.

Second, in the current investigation, we found two domains of impulsive behavior, whereas a study of adults found six domains: work, interpersonal relationships, drugs and alcohol, food, exercise, and finances (Tsukayama, et al., 2012). We hypothesize that this discrepancy is largely due to age-related differences in opportunity, temptation, and perceived harm. In other words, the typical school-age child may not have self-control problems with drugs and alcohol, food, exercise, or finances because these are not frequently encountered, not perceived as tempting, or not perceived as harmful. Longitudinal studies could test this prediction. A related limitation is that the ISC items might over-represent observable behaviors, especially behavior observable at school. This is because our final items were selected based on teacher ratings of prevalence and importance, and because some items from the home context (e.g., "pushing your younger brother or sister") were omitted in the interest of creating parallel scales for teacher, parent, and student (self-report) respondents. Nevertheless, seven of the eight final items are applicable to both the home and school context (e.g., "did not remember what someone said to do"); only one item pertains specifically to school (i.e., "forgot something needed for school"). In sum, we suggest (with support from our data) that the schoolwork and interpersonal domains are important for school-age children, but we do not claim that these represent an exhaustive universe of impulsive behaviors for children.

Third, one of the observed subscale alphas (self-report schoolwork $\alpha = .63$) was lower than conventional rules of thumb for reliability (i.e., $< .70$). We do not, however, see this as a fatal limitation for the following reasons. First, Cronbach's alpha is a lower bound estimate of reliability, suggesting that the true value is higher. Second, the other subscales (i.e., teacher- and parent-report schoolwork impulsivity as well as interpersonal impulsivity for all raters) did quite well on average (avg. $\alpha = .85$), and the subscale composite scores we used in our actual analyses were highly reliable ranging from .86 to .95 (avg. $\alpha = .91$). Finally, in a recent study on the differential reliability and validity of facet scales from the NEO Inventories, McCrae and colleagues (2011) found that internal consistency was virtually unrelated to validity and concluded, "Internal consistency of scales...appears to be of limited utility for evaluating the potential validity of developed scales" (p. 28). This may be because "Higher reliability may be attained by narrowness of content that can limit predictive validity" (p. 29).

Finally, experimental research testing domain-specific interventions would more clearly elucidate causal relationships between domain-specific impulsivity and downstream outcomes. Properly designed, such translational research could both further the basic science of self-control and also serve an important practical purpose.

Conclusion

Research questions of both theoretical and practical importance are suggested by the insight that children who struggle to exercise self-control in the schoolwork context do not always struggle with self-control in interpersonal situations. Do self-control processes, motivation to exert self-control, or impulse strength vary by domain? Of consequence to lifespan development, does self-control begin as a relatively domain-general individual difference and become increasingly differentiated as children mature into adulthood? Finally, are particular domain-specific subtypes of impulsivity more amenable to environmental influence, including direct intervention? The well-known importance of self-control competence for successful development and the centrality of this construct for any complete understanding of human nature suggest that these and related research questions be undertaken in earnest.

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Table 1

Exploratory Factor Analysis Loadings and Internal Reliability Estimates for Student-, Teacher-, Parent-Report Items in Studies 1 and 2

Item	Study 1						Study 2			
	Student		Teacher 1		Teacher 2		Parent		Parent	
	1	2	1	2	1	2	1	2	1	2
Interpersonal Impulsivity										
...interrupted other people	0.54	0.14	0.77	0.11	0.73	0.11	0.45	0.24		
...said something rude	0.75	-0.03	0.96	-0.03	0.98	-0.02	0.59	0.15		
...lost temper	0.66	-0.05	0.92	0.00	0.89	-0.01	0.94	-0.12		
...talked back when upset	0.72	-0.05	0.98	-0.04	0.98	-0.04	0.72	0.01		
Schoolwork Impulsivity										
...forgot something needed for school	0.06	0.58	0.03	0.92	0.01	0.92	-0.08	0.67		
...could not find something because of mess	-0.16	0.58	0.01	0.92	-0.03	0.96	0.14	0.52		
...did not remember what someone said to do	0.05	0.45	0.04	0.81	0.15	0.77	0.09	0.60		
...mind wandered	0.15	0.52	-0.06	0.87	-0.08	0.86	-0.01	0.80		
Cronbach's Alpha										
	0.76	0.63	0.95	0.94	0.94	0.93	0.77	0.81		

Notes. Items were paraphrased for presentation purposes. Factor loadings are from oblique promax solutions (promax $k = 4$). Factor loadings greater than .40 are shown in bold. Factor correlations were .60 for the self-report items, .47 for the teacher 1 items, and .40 for the teacher 2 items, and .65 for the parent items

Two-Factor Confirmatory Factor Analysis Results for Student-, Teacher-, and Parent-Report Models in Study 3

Table 2

	Student		Teacher		Parent	
	1	2	1	2	1	2
Interpersonal Impulsivity						
...interrupted other people	0.56	0.00	0.72	0.00	0.68	0.00
...said something rude	0.73	0.00	0.85	0.00	0.80	0.00
...lost temper	0.62	0.00	0.87	0.00	0.73	0.00
...talked back when upset	0.61	0.00	0.89	0.00	0.85	0.00
Schoolwork Impulsivity						
...forgot something needed for school	0.00	0.44	0.00	0.90	0.00	0.62
...could not find something because of mess	0.00	0.39	0.00	0.93	0.00	0.52
...did not remember what someone said to do	0.00	0.65	0.00	0.76	0.00	0.69
...mind wandered	0.00	0.68	0.00	0.77	0.00	0.69
Cronbach's Alpha	0.72	0.63	0.89	0.91	0.84	0.71
Model Fit Statistics						
χ^2 ($df=19$)	141.36***		362.94***		85.37***	
CFI	0.90		0.92		0.95	
RMSEA	0.097		0.162		0.089	
SRMR	0.05		0.07		0.05	
χ^2 ($df=1$) relative to one-factor model	18.82***		698.42***		91.44***	

Notes. Items were paraphrased for presentation purposes. Factor loadings are from oblique two-factor models. Factor correlations were .88 for the student-report items, .70 for the teacher-report items, and .73 for the parent-report items. Factor loadings are shown in bold and are significant at $p < .001$. Model chi-square and chi-square difference tests are significant at $p < .001$.

Table 3

Domain-Specific Associations Between Interpersonal and Schoolwork Impulsivity and Temperament, Personality, and Other Outcomes

Measure	M	SD	Interpersonal		Schoolwork	p ^a
Study 1						
GPA	81.63	7.64	-.06		-.59***	<.001
Study 2						
GPA	6.57	1.34	-.11		-.31**	0.22
Study 3						
Hours Studying Per Day	1.53	0.92	-.07		-.16*	0.21
Hours Watching TV Per Day	2.46	1.48	.04		.20**	0.02
Temperament						
Activation Control	3.43	0.71	-.07		-.38***	<.001
Attention	3.41	0.57	-.09		-.35***	<.001
Aggression	2.25	0.79	.51***		-.01	<.001
Frustration	3.31	0.61	.26***		-.01	0.004
Surgency	3.11	0.78	.19***		-.04	0.015
Big Five Personality						
Openness to Experience	3.58	0.46	.06		-.21***	0.004
Conscientiousness	3.47	0.62	-.08*		-.68***	<.001
Extraversion	3.34	0.63	.37***		-.12*	<.001
Agreeableness	3.65	0.56	-.59***		-.12**	<.001
Neuroticism	2.83	0.52	.32***		.11*	0.008
Outcomes						
Popularity ^b	2.47	1.93	.02		-.12	0.25
GPA	2.91	0.80	-.06		-.46***	<.001
Conduct Grades	3.86	0.73	-.30***		-.42***	0.12

Note: Betas () are from simultaneous multiple regression equations including both interpersonal and schoolwork impulsivity as predictors. Significantly larger betas within a pair are boldfaced.

^aTwo-tailed *p*-value for the difference in betas.

* *p* < .05.

** *p* < .01.

*** *p* < .001.

Table 4

Cross-Tabulation of Students into High, Medium, and Low Schoolwork and Interpersonal Impulsivity Groupings

Schoolwork Impulsivity	<u>Interpersonal Impulsivity</u>		
	High	Medium	Low
Study 1 (<i>N</i> = 453)			
High	20%	9%	4%
Medium	9%	13%	11%
Low	6%	10%	19%
Study 2 (<i>N</i> = 166)			
High	24%	10%	5%
Medium	6%	13%	14%
Low	4%	5%	18%
Study 3 (<i>N</i> = 712)			
High	22%	8%	2%
Medium	12%	13%	7%
Low	3%	10%	22%