Do individuals higher in impulsivity drink more impulsively? A pilot study within a high risk sample of young adults

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HIGHLIGHTS

- This study examined the mechanisms of the impulsivity-intention relation for alcohol.
- This study utilized a daily diary design with advanced statistical analyses.
- Facets of impulsivity had an indirect effect on alcohol use through intentions to drink.
- Impulsive individuals did not engage in unplanned drinking as hypothesized.

ARTICLE INFO

ABSTRACT

Extant literature has established a strong relation between individual differences in "impulsivity" and alcohol consumption. However, the relation between "impulsivity," intentions-to-drink, and alcohol consumption has remained understudied. As a part of a larger study, 77 participants (60.5% female, 76.3% White, M age = 20.8) completed 10 days of daily diary reports regarding their intention to use alcohol and alcohol consumption. Hierarchical linear modeling (HLM) was used to estimate within-person relations between intentions-to-drink and subsequent alcohol use. All models were adjusted for participant age, biological sex, and day of the week. Results showed a strong positive association between daily intention to consume alcohol and self-reported alcohol use ($\beta = 0.50$, $p < 0.01$). Importantly, tests of interactions indicated that individuals higher in impulsivity were not significantly more likely to engage in unplanned drinking. Multilevel mediation analyses indicated significant indirect effects between impulsivity-like constructs, including positive urgency, lack-of-planning, and self-report delay discounting, and reported daily alcohol consumption via higher overall (i.e., between-person) levels of intentions-to-drink; that is, individuals who reported higher levels of these impulsivity-related constructs were more likely to intend to drink across the 10-days and, in turn, consumed more alcohol. Findings from the study suggest that treatment providers could address drinking intentions among individuals higher in impulsivity and work to establish potential replacement behaviors to reduce alcohol consumption in this population.

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1. Introduction

Decades of research have examined the epidemiology of heavy drinking (and alcohol use disorders [AUDs]) across the lifespan, with several lines of evidence indicating that pathological alcohol involvement is largely a developmental disorder of young adulthood (e.g., Grant et al., 2015, Sher & Gotham, 1999; see Littlefield & Sher, 2010, for a review). Importantly, various measures of impulsivity-related

constructs have also been linked to alcohol outcomes in this population, and there are a number of processes and mechanisms that may account for the impulsivity-alcohol relation (see Littlefield, Stevens, & Sher, 2014).

Impulsivity has been conceptualized and operationalized in a variety of ways (see Evenden, 1999; King et al., 2014), including with self-report assessments as well as neurobehavioral tasks. The UPPS-P formulation of impulsivity (Lynam, Smith, Whiteside, & Cyders, 2006) describes five facets of impulsivity: 1) *sensation seeking*, or the tendency to seek out new and thrilling experiences; 2) *lack-of-planning*, or the tendency to act without thinking; 3) *lack-of-perseverance*, or the inability to remain focused on a task; 4) *positive urgency*, or the tendency to act rashly when experiencing extremely positive emotion; and 5) *negative urgency*, or the tendency to act rashly in response to distress. Further, delay

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discounting, or the preference for smaller, immediate rewards over larger, delayed rewards, is a type of impulsivity that has been assessed using both self-report instruments and neurobehavioral tasks (see Hamilton, Littlefield, et al., 2015b, for a review).

As recently reviewed by the International Society for Research on Impulsivity, lab-based tasks have also been developed to assess so-called rapid-response impulsivity (RRI) – "a tendency toward immediate *action* that occurs with diminished forethought and is out of context with the present demands of the environment" (pp. 168, Hamilton, Mitchell, et al., 2015a). RRI tasks appear to measure two neurobiologically and conceptually distinct types of RRI: refraining from action initiation (as assessed by Immediate Memory Task [Dougherty, Marsh, & Mathias, 2002]) versus failure to stop a prepotent action (as assessed by Go-Stop Impulsivity Paradigm [Dougherty, Mathias, Marsh, & Jagar, 2005]). Performance on the aforementioned tasks has been linked to pathological alcohol use (see Hamilton, Mitchell, et al., 2015a).

Despite that the extant literature indicates impulsivity-like constructs are relevant to alcohol involvement at the between-person level (see Littlefield et al., 2014), there has been little focus on the extent to which these constructs increase the likelihood of unplanned drinking episodes for a given individual across time. Impaired control, defined as the "breakdown of an intention to limit [alcohol] consumption in a particular situation" (Heather, Tebbutt, Mattick, & Zamir, 1993, p. 701), has been identified as a key feature of pathological alcohol involvement and is a current AUD symptom in the *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; *DSM-5*; see American Psychiatric Association, 2013). However, several criticisms of the *DSM-5* conceptualization of impaired control have been proffered (see Martin, Chung, & Langenbucher, 2008), indicating that more ecologically-valid measures of impaired control (e.g., within-person assessments of intentions-to-drink vs. drinking behavior) should be utilized within the alcohol literature.

Impulsivity-related constructs may contribute to unplanned drinking through two different mechanisms. On one hand, individuals higher in certain impulsivity-related constructs may be more likely to drink despite no prior intention; that is, impulsivity may moderate the intention-drinking relation. Alternatively, higher levels of impulsivity-related constructs may simply reflect a greater propensity for individuals to consume alcohol. This latter notion would be supported by results indicating that individuals' higher in levels of impulsivity are more likely to intend to drink, in general, which in turn predicts subsequent alcohol consumption.

Two research questions were tested using daily-diary data, spanning 10 days, among a high-risk sample of young adults: 1) do impulsivity-like constructs moderate the relation between individuals' intentions-to-drink and daily alcohol consumption (Research Question 1), and 2) do individuals' aggregate intentions-to-drink mediate the relation between impulsivity-like constructs and daily alcohol consumption (Research Question 2). Rather than assessing impaired control with a cross-sectional, self-report instrument, we sought to examine a more ecologically-valid measure of "impaired control," reflecting the breakdown of reported behavioral intentions (i.e., consuming more alcohol than intended) across time. Additionally, we utilized various assessments of multiple impulsivity-related constructs that span both self-report and behavioral methodologies. More specifically, the facets of the UPPS-P, self-reported delay discounting from the Monetary Choice Questionnaire (MCQ), and three computer-based neurobehavioral measures of impulsivity were assessed.

Considering the heterogeneous nature of impulsivity, some types may serve to moderate the link between intentions-to-drink and subsequent drinking behaviors. Alternatively, intentions-to-drink may mediate the relation between various impulsivity types and drinking behaviors. Given the exploratory nature of this pilot study, all impulsivity-like constructs were tested in all moderation (Research Question #1) and mediation (Research Question #2) models. Further, with regard to the mediational models, it was important to test whether, when examining daily alcohol consumption, impulsivity was associated with higher daily fluctuations in intentions (referred to as a 2-1-1 model), or if impulsivity was related to higher aggregate intentions to drink across days (referred to as a 2-2-1 model; Krull & MacKinnon, 2001). The rationale for testing both types of mediation was based on a general lack of information in the extant literature examining impulsivity, intentions, and alcohol consumption. Although largely exploratory in nature, a limited number of preliminary, directed hypotheses are proffered based on extant findings or the operationalization of the construct itself.

1.1. Research Question #1

Because individuals higher in the impulsivity facet labeled lack-of-planning should, ostensibly, have a weaker link between their intentions and behavior across domains, we hypothesized that lack-of-planning will moderate relations between individuals' intentions-to-drink and daily alcohol use. Similarly, failure to inhibit a prepotent action (as assessed via Go-Stop paradigm) may also act as a moderator of unintended alcohol use (Marsh, Dougherty, Mathias, Moeller, & Hicks, 2002).

1.2. Research Question #2

We hypothesized those higher in delay discounting (assessed behaviorally and by self-report) will reliably express greater fluctuations in (i.e., 2-1-1) or greater overall (i.e., 2-2-1) intentions-to-drink, reflecting the preference for more immediate rewards (i.e., alcohol consumption) over potential long-term consequences from use. This notion is conceptually supported by a preference for immediate rewards being reflective of greater intentions to consume alcohol, rather than intending to engage in behavior for anticipated long-term rewards (e.g., Kirby, Petry, & Bickel, 1999). No a priori hypotheses were made for response initiation, lack-of-perseverance, sensation seeking, or urgency (positive or negative).

2. Methods

2.1. Participants

Seventy-seven participants (60.5% female, 76.3% White, 26.3% Hispanic/Latino, 93.42% enrolled in college, M age = 20.8, SD = 1.9) were recruited for this study from a large, southwestern community. To meet the larger aims of data collection, inclusion criteria included age restrictions (i.e., 18–25) and endorsement of at least one binge-drinking episode and one unprotected sexual encounter (vaginal or anal) in the 30 days prior. All study procedures were approved by the affiliated university's Institutional Review Board, and all participants were reimbursed for their time. See Table 1 for daily percentages of alcohol consumption.

2.2. Study protocol

Eligible participants completed baseline and follow-up measures in a laboratory setting. Upon completion of the baseline visit, participants initiated a 10-day diary phase, for which reports were completed online. Participants were emailed links to the assessment every day at 7:30 am, and the survey closed at 2:00 pm each day. An average of 8.1 (SD = 2.4; range: 0–10) daily diary reports were completed by each participant.

Table 1
Percentage of daily alcohol consumption.

Day of week	Level-1 N	% yes	% binge drinking
Thursday*	621	44.93	10.15
Friday*	558	53.23	14.52
Saturday*	549	60.66	13.11
Sunday	603	25.37	8.96
Monday	585	21.54	3.08
Tuesday	603	16.42	4.48
Wednesday	567	31.25	7.81
Thursday*	567	36.51	4.76
Friday*	495	58.18	20.00
Saturday*	495	47.27	12.72

Note. Asterisk denotes "weekend day" for the purposes of this study. Binge drinking is defined as consuming $5+$ drinks for males and $4+$ drinks for females within a two-hour period. Percentage of binge drinking was only calculated for participants who reported consuming at least one standard drink on a given day. $n = 55$–69 for level-2.

2.3. Measures

2.3.1. Demographics

Participants completed demographic questions, assessing age, biological sex, race, and ethnicity.

2.3.2. Self-reported impulsivity

Lack-of-planning, lack-of-perseverance, negative urgency, positive urgency, and sensation seeking were assessed using the 59-item UPPS-P Impulsive Behavior Scale (Lynam et al., 2006). Participants were instructed to select which number on the 5-point Likert scale best described his/her behavior, with higher subscale sum scores reflecting higher impulsivity ($\alpha = 0.81$–0.93 across scales).

2.3.3. Delay discounting

Delay discounting was assessed using the 27-item Monetary Choice Questionnaire (MCQ; Kirby et al., 1999). For each item, participants chose between hypothetical small, immediate monetary rewards and large, delayed monetary rewards. Analyses used the average discounting curve (k) across small, medium, and large delayed rewards (see Kirby et al., 1999, for more details). Participants with a higher k value discount large, delayed rewards more often, reflecting higher levels of impulsivity.

2.3.4. Behavioral tasks of impulsivity

The Two Choice Impulsivity Paradigm (TCIP) is a discrete-choice computer-based task that assesses delay discounting (Dougherty et al., 2005). The participant could choose between clicking a circle to earn five points after a five-second delay or clicking a square to earn 15 points after a 15-second delay. Impulsivity is defined as a preference for smaller, immediate rewards (test re-test $r = 0.46$).

The Go-Stop Impulsivity Paradigm is a stop-signal task that measures response inhibition in relation to impulsivity (Dougherty et al., 2005). Participants were presented five-digit numbers on the computer screen and instructed to click the mouse if the trial was a matching stimulus while a number was presented on the screen, but to inhibit the click if the number turned red. A lower percentage of inhibited responses reflected increased impulsivity (Marsh et al., 2002; test re-test $r = 0.47$); thus, an increased percentage of failed inhibited responses in this measure reflected greater impulsivity.

The Immediate Memory Task (IMT) is designed to assess response initiation aspects of impulsivity (Dougherty et al., 2002). Participants were presented five-digit numbers on the computer screen and instructed to click the mouse when the set of numbers on a particular trial matched the set from the trial immediately preceding it (Dougherty et al., 2002; test re-test $r = 0.75$). Consistent with previous research, the IMT ratio is calculated as the commission-errors proportion divided by the correct-detection proportion, which reflects errors in expected response initiations (Dougherty et al., 2002).

2.3.5. Daily intention-to-consume alcohol

Intention to use alcohol was assessed in each daily diary report for the current day via a continuous, single-item measure (e.g., "How many more drinks do you intend to consume today?").

2.3.6. Daily alcohol use

Alcohol use was assessed in each daily diary for *yesterday's* alcohol use (e.g., "How many drinks did you consume yesterday?").

2.3.7. Daily mood

Daily mood was assessed in each daily diary report for the current day. Participants were instructed to select which number on the 5-point Likert scale best described his/her mood. A sum score was created for positive affect using six adjectives (e.g., enthusiastic) and negative affect using five adjectives (e.g., irritable).

3. Statistical analysis

Hierarchical linear modeling (HLM) analyses were conducted using SAS PROC MIXED (SAS Institute, Inc., Cary, North Carolina) and Mplus Version 7 (Muthén & Muthén, 2012). To account for between-person (level-2) variations in impulsivity-like constructs, a given individual's overall mean was centered around the sample grand-mean (Curran & Bauer, 2011). Within-person (level-1) variations in intentions-to-drink were assessed by creating a person-centered variable (e.g., each individuals' repeated intention score was centered around his/her average level of intentions-to-drink, across days), such that a positive (or negative) value for intention, for a given participant on a particular day, reflected above- (or below-) average intentions (Curran & Bauer, 2011; Raudenbush & Bryk, 2002). A random intercept and random slope for within-person intention were included in all models. All models were adjusted for participant age, biological sex, and day of the week (i.e., weekday daily diary report [Sunday–Wednesday = 0] vs. weekend daily diary report [Thursday–Saturday = 1]). Models that focused on positive and negative urgency facets also included respective, daily person-centered mood scores (e.g., positive mood for positive urgency).

Cross-level interactions between within-person intentions-to-drink and between-person impulsivity constructs were examined to test moderation hypotheses. Multilevel mediation analyses (Zhang, Zyphur, & Preacher, 2009) were conducted to examine the extent to which between- and within-person intentions-to-drink mediated the impulsivity-alcohol relation. Indirect effects (IEs) were computed using product-of-coefficients, as recommended by Zhang et al. (2009). Formal tests of IEs were conducted in RMediation (Tofighi & MacKinnon, 2011). To estimate missing data, maximum likelihood (ML) was used in all analyses.

4. Results

Sixty-eight out of 77 participants (88.31%) reported consuming at least one standard drink during the 10-day daily diary phase. Of those, 46.75% endorsed binge drinking at least one of these days. See Table 2 for descriptive statistics of between-person and within-person variables. For both research questions, separate models were estimated for each impulsivity facet (see Table 3 for between-person correlations among impulsivity-like constructs; see Table 4 for the average intended number of daily drinks and the average number of reported drinks consumed on subsequent [i.e., lagged] days).

Table 2

Descriptive statistics of between- and within-person variables.

Variable	Mean	Standard deviation
Negative urgency	28.36	6.00
Positive urgency	28.01	8.31
Sensation seeking	37.80	6.37
Lack-of-planning	21.25	5.13
Lack-of-perseverance	18.29	4.38
Average k	0.02	0.03
GoStop Failure %	31.04	18.50
TCIP Immediate Choices	16.73	12.81
IMT ratio	0.35	0.15
Between-person average daily intention	1.43	0.43
Within-person daily intention	0.02	0.68
Within-person daily alcohol consumption	1.57	0.89

Note. Average k value (as assessed by the Monetary Choice Questionnaire) was log-transformed. Level-2 intention was square root-transformed. GoStop Failure % reflects the percentage of failed inhibited responses, such that a greater percentage of failed responses reflects greater impulsivity. The Two Choice Impulsivity Paradigm (TCIP) Immediate Choices reflects the number of immediate (versus delayed) choices, such that increased immediate choices reflects greater impulsivity. The Immediate Memory Task (IMT) ratio reflects the proportion of commission errors divided by the proportion of correct detections, such that a larger IMT ratio reflects greater impulsivity. $n = 75$–76 for between-person variables. $N = 495$–621 for within-person variables.

4.1. Research Question #1

Increases in within-person intentions-to-drink were positively associated with increases in the number of daily drinks ($\beta = 0.50$, $p < 0.01$). However, there was no evidence that impulsivity constructs moderated the intention-drinking relation; cross-level interactions were non-significant across all models, and pseudo R^2 values (i.e., proportional reduction in prediction error at level-1; Hayes, 2006; Snijders & Bosker, 2012) indicated trivial effect sizes for interaction terms (pseudo R^2 range: 0.05%–0.24%).

4.2. Research Question #2

Using "2-1-1" models (i.e., between-person impulsivity scores predicting within-person daily intentions-to-drink, which, in turn, predict subsequent daily alcohol consumption), there were no significant IEs of impulsivity facets on daily levels of alcohol consumption via intentions-to-drink (IE ≤ 0.01 for all models). Alternatively, using "2-2-1" models (i.e., between-person impulsivity scores predicting aggregate between-person intentions-to-drink, which, in turn, predict daily alcohol consumption), the IE of positive urgency on alcohol consumption, via higher average intentions-to-drink, was statistically significant (IE = 0.02, 95% Confidence Interval [CI] = 0.01, 0.03), such that individuals higher in positive urgency reported greater intentions-to-drink across days, which, in turn, predicted elevated daily alcohol

Table 4

Daily intended and reported alcohol consumption.

Day of week	Level-1 N	M (SD) Intended number of drinks to consume	M (SD) Reported number of drinks consumed
Friday*	621	3.68 (4.37)	3.39 (5.00)
Saturday*	558	2.92 (4.13)	4.21 (5.58)
Sunday	549	0.98 (2.50)	1.30 (3.29)
Monday	603	0.22 (0.95)	0.80 (2.09)
Tuesday	585	0.69 (2.95)	0.73 (2.20)
Wednesday	603	0.87 (2.33)	1.22 (2.26)
Thursday*	567	1.21 (2.98)	2.00 (3.43)
Friday*	567	2.25 (3.56)	4.24 (4.67)
Saturday*	495	3.00 (4.17)	3.07 (4.71)

Note. Asterisk denotes "weekend day" for the purposes of the current study. Participants completed a short tutorial and training quiz on standard-drink equivalencies (National Institute on Alcohol and Alcoholism [NIAAA], 2000) prior to answering questions about typical quantity and frequency of alcohol use. $n = 55$–69 for level-2.

consumption. Similarly, the IE for lack-of-planning on daily alcohol consumption, via higher average intentions-to-drink, was significant (IE = 0.02, CI = 0.01, 0.03). Finally, the IE of self-reported delay discounting (i.e., average k value) on daily alcohol consumption, via higher average intentions-to-drink, was significant (IE = 8.11, CI = 5.50, 11.02). See Figs. 1–3 for illustrations of significant "2-2-1" mediation models. Between-person differences in intentions-to-drink did not significantly mediate any other associations between types of impulsivity and daily alcohol consumption.

5. Discussion

Problematic alcohol involvement is linked to a host of negative consequences and understanding individual differences that contribute to elevations in drinking among at-risk individuals is necessary for improving treatment. To our knowledge, this is the first study to examine the interplay between types of "impulsivity" and intentions-to-drink in a high-risk sample of young drinkers to determine how these influences combine to predict daily alcohol use. Although within-person intentions-to-drink were related to daily levels of alcohol consumption, there was no evidence that distinct facets of impulsivity moderated this relation. However, some impulsivity types had an indirect influence on daily alcohol consumption levels through greater, overall intentions-to-drink across days.

Consistent with preliminary hypotheses, between-person intentions-to-drink mediated the relation between self-reported delay discounting (assessed via the MCQ) and daily alcohol consumption. Given that intentions-to-drink was assessed for "same-day" reports of alcohol consumption, it is likely that young adults higher in delay discounting were potentially discounting less immediate rewards/consequences (e.g., having next-day role impairment as a result of an

Table 3

Between-person correlations among impulsivity-like constructs (self-report and behavioral).

Variable	LPl	LPer	SS	PU	NU	Avg k	GoStop	IMT	TCIP
LPl	1.00								
LPer	0.39*	1.00							
SS	0.26*	0.05	1.00						
PU	0.44*	0.13	0.39*	1.00					
NU	0.45*	0.33*	0.38*	0.70*	1.00				
Avg k	0.13	0.12	0.14	0.28*	0.23*	1.00			
GoStop	0.12	−0.09	0.21	0.05	0.20	−0.01	1.00		
IMT	0.13	−0.04	0.02	0.08	0.07	−0.24*	0.38	1.00	
TCIP	−0.13	0.23*	−0.09	−0.05	0.17	0.14	0.01	−0.03	1.00

Note. LPl = lack-of-planning; LPer = lack-of-perseverance; SS = sensation seeking; PU = positive urgency; NU = negative urgency; Avg k = average k value from MCQ; GoStop = % response inhibition failures; Immediate Memory Task (IMT) = response initiation; Two Choice Impulsivity Paradigm (TCIP) = number of immediate choices.
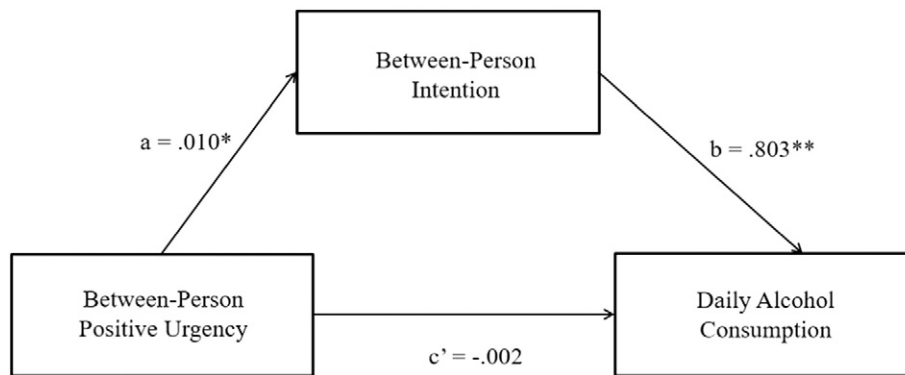
  * $p < 0.05$.

Fig. 1. "2-2-1" multilevel mediation model with level-1 intention mediating the relation between level-2 positive urgency and level-1 alcohol consumption. $^*p < 0.05$. $^{**}p < 0.01$. $n = 76$.

alcohol-induced hangover) in lieu of more immediate rewards (e.g., reinforcement from daily alcohol consumption). However, a corresponding behavioral measure of delay discounting (TCIP) did not significantly relate to aggregate levels of intentions-to-drink or daily alcohol consumption, and interestingly, the TCIP did not significantly correlate with the MCQ (see Table 3), which is consistent with prior work highlighting the heterogeneous nature of impulsivity across measurement paradigms (see Cyders & Coskunpinar, 2012). Indeed, the neuro-behavioral measures of impulsivity did not show direct or indirect effects on daily alcohol consumption and only correlated with two self-report measures of impulsivity, indicating that behavioral tasks of impulsivity may capture variance in impulsivity-like constructs other than that which is captured by self-report assessments. As was done here, future studies would benefit from (a) prioritizing recommended measures of impulsivity (such as the UPPS-P, the measure of impulsivity recommended by the National Institutes of Health Phen-X toolkit, Hamilton et al., 2011) to improve data harmonization and (b) utilizing multi-method approaches to rule out (or at least identify) potential measurement confounds when devising studies that include impulsivity-related constructs.

In multilevel mediation analyses, increases in positive urgency related to greater between-person levels of intentions-to-drink, which, in turn, were associated with increased daily alcohol consumption. This may reflect that consuming alcohol is primarily viewed as a positive activity among young adults (Schulenberg & Maggs, 2002), which may factor heavily into pre-planning of drinking-related activities, such as weekend parties and tailgates (Lewis et al., 2011). It may be that young adult drinkers who tend to agree with statements from the positive urgency scale (e.g., "When I am really ecstatic, I tend to get out of control.") are inadvertently self-referencing occasions that involved both positive moods and alcohol consumption (e.g., parties) given that these strong positive mood states are more likely to occur in settings that involve alcohol, compared to other situations (e.g., while at school).

Thus, higher levels of positive urgency may reflect the tendency for a young adult to plan for, and subsequently engage in, activities involving alcohol consumption rather than unplanned drinking occasions.

Interestingly, individuals higher in lack-of-planning were more likely to intend to consume alcohol across days, which positively predicted subsequent levels of daily alcohol use. This was not only contrary to our hypotheses but, at face-value, seems inconsistent with definitions of the construct. Nevertheless, it appears that young adults from a high-risk sample who reported higher levels of lack-of-planning are capable of consuming alcohol in a planful manner. Thus, broadband measures assessing a general lack-of-planning may not capture the extent to which one is planful across all contexts (e.g., an individual may plan for an upcoming drinking episode but lack forethought regarding upcoming work- or school-related obligations). This notion aligns with the argument made by Fleeson (2001), stating that within-person variations in personality "states" are evident across weeks of assessment and contextually dependent (Fleeson & Noftle, 2008).

Overall, results of this study demonstrate that the relation between impulsivity and alcohol consumption remains complex. Results from this study mirror findings from the extant drinking motives literature, which has yet to find consistent moderating effects predicting daily alcohol consumption (see Armeli, Conner, Cullum, & Tennen, 2010). Given the limited work devoted to understanding the impulsivity-intention relation, there is evidence from the current study to suggest that future studies in this area would be beneficial.

5.1. Limitations and future directions

Strengths of the study include the use of advanced statistical modeling to test mediation across multiple levels of analysis, a multi-method approach using validated behavioral and self-report measures of multiple impulsivity constructs, and the focus of these processes within a high-risk sample of young adults. This study also highlights potential
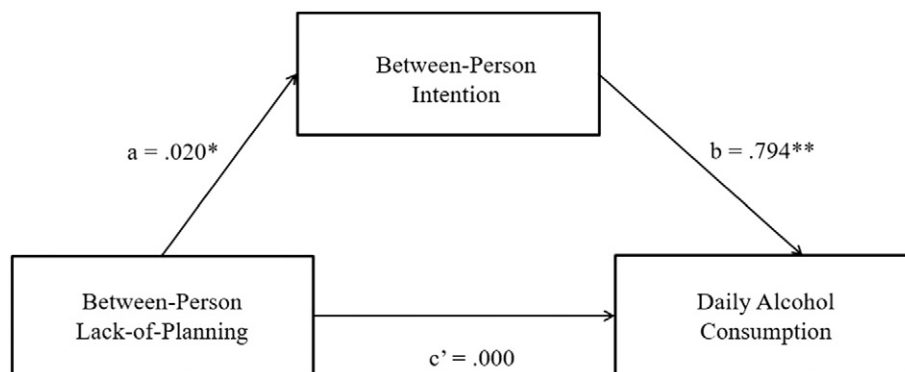

Fig. 2. "2-2-1" multilevel mediation model with level 2-intention mediating the relation between level 2-lack-of-planning and level 1-alcohol consumption. $^*p < 0.05$. $^{**}p < 0.01$. $n = 76$ for level-2, $N = 684$ for level-1.
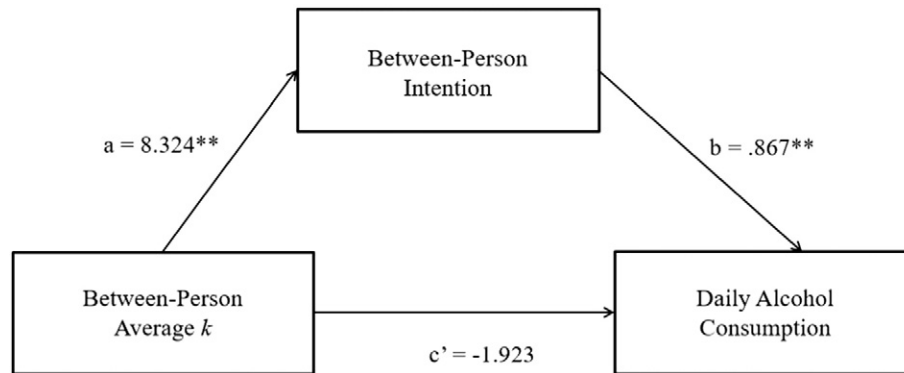
Fig. 3. "2-2-1" multilevel mediation model with level 2-intention mediating the relation between level 2-average k (i.e., self-report delay discounting) and level 1-alcohol consumption. $**p < 0.01$. $n = 76$ for level-2, $N = 684$ for level-1.

for an ecologically-valid assessment method for unplanned drinking (i.e., impaired control) through the discrepancy of within-person intentions-to-drink and subsequent alcohol consumption. Nevertheless, this high-risk sample was predominantly White, and thus, generalization to other populations should be made with caution. Additional limitations of this study include the limited time window of assessments, potential for social desirability bias in self-report measures, and existence of missing data (although completion rates were commensurate with similar, published diary studies [e.g., Simons, Dvorak, Batien, & Wray, 2010]). Future studies might also consider examining momentary assessments of impulsivity (Tomko et al., 2014) in addition to the measures considered in the current work.

In sum, findings from this study suggest that young adults high in distinct types of impulsivity have a greater propensity to intend-to-drink and subsequently consume more alcohol, rather than engage in unplanned drinking. To our knowledge, this is the first study to examine the interrelations between impulsivity, intentions, and drinking behaviors in a high-risk sample of young adults using multiple assessment methods and advanced mediational approaches. However, given this is a pilot study, results are considered preliminary, and replication studies are needed. With these limitations in mind, these results do suggest that young adults high in impulsivity drink planfully, which could inform treatment strategies for healthcare providers (e.g., identifying potential replacement behaviors among those intending to consume alcohol; Witkiewitz, Marlatt, & Walker, 2005).

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