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Multidimensionality in Impulsivity and Alcohol Use: A Meta-Analysis using the UPPS Model of Impulsivity

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Abstract

Background—Although there is considerable support for the relationship between impulsivity and alcohol use, the use of multidimensional conceptualizations of impulsivity and alcohol use has lead to varying relationship sizes across studies. The aims of the current meta-analysis are to (1) examine variability in the magnitude of the bivariate relationship between impulsivity and alcohol use across studies, and (2) describe the pattern of effects between specific impulsivity traits and alcohol use variables, using the UPPS Model of Impulsivity.

Methods—Ninety-six studies were meta-analyzed using a random effects model to examine the relationship between general impulsivity and alcohol use, as well as the relationships among separate impulsivity traits based in the UPPS model of impulsivity and specific alcohol use outcomes.

Results—Results indicate that, in general, impulsivity and alcohol use are related (r = .28); however, this effect size varied significantly across studies (from −.05 to 1.02). Drinking quantity was most strongly predicted by lack of perseverance (r = .32), whereas all traits equally predicted drinking frequency. Drinking problems were most highly related to negative (r = .35) and positive (r = .34) urgency, and alcohol dependence was most highly related to negative urgency (r = .38) and lack of planning (r = .37).

Conclusion—Effect sizes between impulsivity and alcohol use vary significantly by UPPS trait used in each study; thus, findings suggest and further reinforce the view in the literature that specific impulsivity-related constructs differentially relate to specific alcohol use outcomes.

Keywords

impulsivity; alcohol; meta-analysis

Introduction

Impulsivity and Alcohol Use: A Small but Important Relationship?

There is a plethora of research implicating impulsivity as a risk factor for alcohol use (see Acton, 2003; Dick et al., 2010; Mulder, 2002): Effect sizes range from small (e.g., Friese and Hoffman, 2009) to large (e.g., Townshend and Duka, 2005), in both alcohol use disorders (Dougherty et al., 2004; Finn et al., 2005; Mitchell et al., 2005) and non-pathological alcohol use (Cyders et al., 2009; Fischer et al., 2004). While this relationship has been replicated across clinical and non-clinical samples of college students (e.g., Balodis et al., 2009; Dom et al., 2007; Franken and Muris, 2006; Ibáñez et al., 2010), adolescents

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(e.g., Aklin et al., 2005; Gunnarsson et al., 2008; Woicik et al., 2009), and children (e.g., Gunn and Smith, 2010; MacPherson et al., 2010; Sargent et al., 2009), some research has failed to find evidence supporting the role of impulsivity in alcohol use (e.g., Sher et al., 2000). Thus, although there does appear to be a relationship with alcohol use, the size of the relationship varies greatly between studies.

One potential explanation for this variability in effect sizes across studies is the measurement of distinct impulsivity traits across different studies, each of which has a different relationship strength with drinking outcomes (e.g., Camatta and Nagoshi, 1995; Ibáñez et al., 2010; Smith et al., 2007). When averaging across relationships of differing magnitudes, as is done when examining relationships using multidimensional traits, small or non-significant relationships often result (Smith et al., 2003). The goal of this paper is to examine the more specific relationships between separate impulsivity-related constructs, based on the UPPS model of impulsivity (Whiteside and Lynam, 2001), and specific alcohol use outcomes, in order to describe more robust patterns of associations. Attempts to determine and reliably measure multidimensional conceptualizations of impulsivity have been undertaken (e.g., Whiteside and Lynam, 2001) and have clarified some of our understanding about the relationship between impulsivity and alcohol use.

Multidimensionality of Impulsivity: Towards Separate Underlying Traits

Impulsivity has been conceptualized as multiple different traits that must be disaggregated (e.g., Whiteside and Lynam, 2001). Whiteside and Lynam (2001) factor analyzed existing measures of impulsivity and identified four traits thought to relate to impulsive behavior: (1) lack of perseverance, representing the tendency to not finish tasks; (2) lack of planning, involving acting without thinking; (3) sensation seeking, encompassing behavior tendencies of trying new and exciting activities or sensations; and (4) negative urgency, representing the tendency to act rashly in response to extreme negative emotions (Whiteside and Lynam, 2001). More recent research has identified a positive emotion variant of urgency known as positive urgency, representing the tendency to act rashly in response to extreme positive emotions (Cyders et al., 2007). These five dispositions towards impulsivity are measured in the UPPS-P Impulsive Behavior Scale (Lynam et al., 2007) and this model has been validated for use in various samples, such as young adult samples, clinical samples, and child/adolescent samples (see Cyders, 2011, for a more thorough review). Given the robustness of this model, and since previous measures were analyzed in creation of the UPPS-P, existing impulsivity measures can be organized along one of the five dispositions (Lynam et al., 2007), thus making the UPPS-P model a prime framework in which to conduct this meta-analytic review.

Disaggregating impulsivity into five traits has provided evidence that these dispositions toward impulsivity are differentially related to alcohol use (Smith et al., 2007); however, research often describes inconsistencies in the prediction of outcomes by the specific traits when controlling for the other traits; these findings can be unstable and inconsistent due to sample characteristics and correlations among the predictor variables (e.g., Cyders et al., 2009; Lynam and Miller, 2004; Magid and Colder, 2007; Miller et al., 2003; Whiteside and Lynam, 2009; Whiteside et al., 2005). More consistency is found when examining uncorrected bivariate relationships. For example, sensation seeking predicts drinking frequency while positive urgency predicts drinking quantity and problems, though both traits were bivariately related to all three outcomes, with effect sizes ranging from small to medium (Cyders et al., 2009). Additionally, factors such as sampling characteristics like age, race, and sex could be affecting the variance in the above-cited findings, as samples studied varied in age, race, and sex composition (as in LoCastro et al., 2000). Cyders (2011) found that although men report higher levels of positive urgency and sensation seeking than women, these mean level differences do not differentially affect the predictive relationship

of these traits for alcohol use. Most research with the UPPS-P traits has controlled for these variables, suggesting a small confounding role of these covariates.

Initial Attempts in Disaggregating Alcohol Use Aspects

The literature on alcohol use covers a wide range of behaviors and effects related to drinking. However, it is unlikely that all of these aspects of alcohol use stem from the same underlying mechanism. Some studies have already begun to consider how separate aspects of alcohol use might be differentially predicted by the UPPS-P traits. Curcio and George (2011) report that sensation seeking predicted frequency and quantity of alcohol use, whereas positive and negative urgency were unique predictors of alcohol-related problems. Alternatively, Shin et al. (2012) found that sensation seeking and negative urgency were the most consistent predictors of multiple alcohol outcomes. Therefore, although attempts to examine relationships among specific dispositions are underway, there is little consensus in their findings. If present, these differential relationships could suggest different mechanisms or consequences associated with impulsivity-related traits, which would greatly inform attempts to treat or prevent such alcohol behaviors. Given the wealth of existing data examining the relationship between impulsivity and alcohol use, a meta-analytic approach is well suited to further examine specific relationships.

The Current Study

This paper presents results from a meta-analysis examining existing patterns of relationships among the specific UPPS-P traits and alcohol use outcomes. Doing so will help to highlight varying relationship magnitudes among these constructs and inform research and clinical interventions more specifically than examining multidimensional, and thus “watered down,” relationships (Smith et al., 2003). Such cumulative findings can help to advance the science of the relationship between impulsivity and alcohol use (Cyders and Coskunpinar, 2011). The current paper reviews previously published research to (1) examine variability in the magnitude of the bivariate relationship between impulsivity and alcohol use across studies, and (2) describe the pattern of effects between specific UPPS-P traits and alcohol use outcomes.

The multidimensional conceptualization of impulsivity that is based on the UPPS-P involves specification of five separate traits related to impulsive action (see Table 1). Disaggregated alcohol outcomes used in this review can be seen in Table 2. Although other variables could be examined, we chose the following categories to focus on clinically-relevant alcohol use outcomes, as follows: (1) some previous evidence has showed differential prediction of alcohol quantity and alcohol frequency (e.g., Cyders et al., 2009) and thus it seems prudent to separate these two facets; (2) problematic alcohol use outcomes are measured in various ways in the literature (such as alcohol dependence vs. problems experienced due to use), and it is our view that these different outcomes could be predicted by different risk factors; (3) given that most binge drinkers are non-dependent, 92% of excessive drinking U.S. adults report recent binge drinking, and binge drinking is associated with multiple health risks, (CDC, 2010), examination of differential risks for binge drinking seems warranted; and (4) given that many studies only denote a vague construct of “alcohol use,” we wanted to include this general variable as an initial point of examination.

We expected a small, although significant, effect size between general impulsivity and general alcohol consumption. However, due to the many different conceptualizations of impulsivity and alcohol use outcomes used across studies, we expected the magnitude of effect sizes across studies to vary significantly. We then examined the specific effects between each facet of impulsivity and the above-noted alcohol outcomes, examining which impulsivity facets had the largest effect for each outcome. We also examined the ability of

sex, age, race, and clinical status of the sample to moderate the overall relationship between impulsivity and alcohol use outcomes. Finally, we examined how the specific trait of impulsivity, the specific alcohol use outcome assessed, and the measures used to assess these traits and outcomes, might moderate these effect sizes.

Materials and Methods

Selection of Studies

A literature search was conducted using Medline, PsychInfo, PsychArticles, and Web of Science covering articles published up to July 2012. Key words included all possible combinations of (1) self-report terms for impulsivity and (2) dependent variables of interest. For the self-report terms, the following key words were included (see Tables 1 and 2 for citations): impulsivity, sensation seeking, novelty seeking, lack or perseverance, lack of planning, lack of premeditation, urgency, negative urgency, and positive urgency. The outcome variables included the following key words: alcohol use, alcohol abuse, alcohol dependence, drinking, quantity, frequency, problematic drinking, binge drinking, and alcohol addiction. Additional search terms for the self-report impulsivity construct were as follows: Barratt Impulsiveness Scale, Dickman's Functional and Dysfunctional Impulsivity Scales, EASI-III Impulsivity Scale, I-7 Impulsiveness Questionnaire, Multidimensional Personality Questionnaire, Personality Research Form, Sensation Seeking Scale, Temperament and Character Inventory, the UPPS-R Impulsive Behavior Scale, the UPPS-P Impulsive Behavior Scale, and the Positive Urgency Measure. Additional terms for the drinking outcome variable were as follows: AUDIT, Drinking Styles Questionnaire, Michigan Alcoholism Screening Test, Timeline Follow Back, NIAAA Quantity Frequency, Concordia Lifetime Drinking Questionnaire, and DSM.

Criteria for inclusion and exclusion—Studies were included if they (1) contained empirical measurement of both self-report of impulsivity and drinking behavior, (2) utilized measures of impulsivity that mapped onto the UPPS model, and (3) either compared a group of drinkers to non-drinkers on an impulsivity measure or provided a parametric statistic of the relationship between impulsivity and alcohol use. Studies were excluded if (1) substance use, which in most cases included more than just consumption of alcohol, such as other drugs, was assessed, (2) there was no comparison group, or if the comparison made was between an alcohol group and a substance abuse group, (3) the articles were not available in English, or (4) the impulsivity measure was unable to be coded onto the UPPS model (e.g., measures not utilized in the development of the UPPS, see Table 1)[1]. If published studies did not include data in a form that could be coded for the meta-analysis, authors were contacted via email and given a one month time period in which to respond and provide the necessary information. A flowchart including numbers of studies excluded for each criterion is included in Figure 1.

Coding of the Studies

The first and second author coded information gathered from the studies independently in order to determine agreement between the coding designations. Each measure was coded as either (1) one of the five UPPS impulsivity facets (based on findings from Whiteside and Lynam, 2001) or (2) one of the seven alcohol outcome domains, as shown in Tables 1 and 2. Another author recoded a portion of the studies in order to determine inter-rater agreement, and re-training and discussion was undertaken until agreement could be reached on codes.

[1]All analyses were replicated using only data derived from studies which specifically utilized the UPPS-P or UPPS-R measure; no significant differences were found in either the overall relationship between impulsivity and alcohol use, nor the more specific associations and moderational analyses.

Meta-Analytic Method

Mean effect sizes were calculated by the third author as suggested by Lipsey and Wilson (2001) using SPSS 19.0 and macros provided by Wilson (2010). A random effects model was employed to produce the most conservative estimates (Lipsey and Wilson, 2010). Correlation values were weighted by sample size and were converted using a Fisher's *z* transformation. All data were coded so that higher values of statistics indicated higher levels of impulsivity or drinking behavior. Several articles contributed more than one effect size. When results for multiple distinct samples were reported in the same article, they were considered separate samples for the purposes of calculating effect sizes. When results for distinct associations were reported in the same article, they were considered separate effect sizes. In this situation, independence of effect sizes was ensured because we analyzed mean effect sizes separate for each association. However, if the data from one study reported multiple values for the same association, these values were averaged to ensure that each study only contributed one effect size to the mean effect of the construct being examined. For the overall impulsivity-alcohol effect size, multiple effect sizes were averaged for each study.

Q-tests and follow-up *z* tests were utilized to determine which effect sizes were the largest for each outcome measure. Meta Regression examined the ability of predominant sex of the sample (1 = less than 5% male to 7 = greater than 95% male), predominant race of the sample (0 = greater than 60% white and 1 = not greater than 60% white), mean age of the sample, and sample status (alcoholic adult, non-clinical adults, adolescents and children, alcohol dependent adults, adolescents and children, clinical adults, adolescents, and children) to predict effect size magnitude of the overall relationship between impulsivity and alcohol use. Meta analysis of variance was used to examine how impulsivity construct, impulsivity measure, alcohol construct, and alcohol measure utilized could predict effect size magnitude across studies. A fail-safe *N* analysis was conducted for each relationship, to estimate the number of studies with null findings that would cause the effect sizes found in a meta-analysis to drop to non-significant levels (Lipsey and Wilson, 2001; Rosenthal, 1979). Effect sizes of 0.10 were considered small, effect sizes of 0.25 were considered medium, and effect sizes greater than or equal to 0.40 were considered large (Lipsey and Wilson, 2001).

Results

Study Sample

The final study sample consisted of 96 studies. The mean size of the samples included was 397.6. The mean age for the samples was 21.66 (*SD* = 8.53). Ninety percent of the studies were correlational studies, whereas the rest were group-comparison studies. Fifty-eight percent of the studies utilized non-clinical adults, followed by non-clinical adolescents (20%). Sixty percent of the samples had predominantly female and Caucasian subjects (more than 50% female; more than 60% Caucasian). Table 3 (see online supplement) displays the studies included in the meta-analysis, with a description of the study design, sample size, demographics, associations provided by the study, and the original effect sizes.

Mean Effect Sizes

Table 4 presents the mean effect sizes, confidence intervals, *z* test, number of studies, total sample size, and fail-safe *N* results for each association. Table 4 also notes which UPPS traits had the largest effect size for each alcohol outcome. Statistics are provided only in cases where two or more studies reported data pertaining to the particular association.

Meta-Analytic Findings

General impulsivity and alcohol consumption—The mean sample-size weighted effect size between impulsivity and alcohol consumption was significant and medium, at r = .28 (SE = .01; CI = .25 – .30, based on 96 studies). This effect size was significantly different from zero (z = 21.06, p < .001) and varied significantly across studies (Q = 483.71, df = 85, p < .001, based on the fixed effects value of r = .26, CI = .25 – .27, SE = .01), ranging from −.05 to 1.02 (weighted SD .12). We also examined how the specific UPPS-P traits might differentially relate to general alcohol use; these values ranged from r = .27 (p < .001 for sensation seeking and lack of planning) to r = .32 (p < .001 for lack of perseverance). These effect sizes were not significantly different from each other (Q = .86, df = 4, p = .93). A classic fail-safe N test for the overall impulsivity and alcohol consumption association revealed that it would take 178 missing studies with null effects to reduce the effect to non-significance.

Impulsivity facets and drinking quantity—The effect sizes for the prediction of drinking quantity ranged from r = .17 (p < .001; negative urgency) to r = .32 (p < .001; lack of perseverance), and were significantly different from each other across the different impulsivity traits (Q = 17.37, df = 3, p < .001). The significantly largest effect size was for lack of perseverance (r = .32, p < .001); the remaining effect sizes were not significantly different from each other. No association could be found for positive urgency.

Impulsivity facets and drinking frequency—Effect sizes for drinking frequency ranged from r = .21 (for lack of planning) to r = .28 (for lack of perseverance) and were not significantly different across the impulsivity traits (Q = 2.46, df = 3, p = .48). The relationship between positive urgency and drinking frequency could not be examined.

Impulsivity facets and alcohol dependence and alcohol problems—Effect sizes for alcohol dependence ranged from r = .22 (for sensation seeking) and r = .38 (for negative urgency). These varied significantly from each other (Q = 13.17, df = 3, p < .01). The strongest effects were for negative urgency (r = .38) and lack of planning (r = .37), which were not significantly different from each other. Effects for alcohol problems ranged from r = .17 (for sensation seeking) to r = .34 (for both negative and positive urgency). They were significantly different from each other (Q = 17.00, df = 4, p < .05), with the largest effect sizes for negative urgency (r = .34, p < .001) and positive urgency (r = .34, p < .001).

Impulsivity facets and binge drinking—Effect sizes for binge drinking ranged from . 13 (for negative urgency) to .36 (for sensation seeking) and were significantly different across impulsivity trait (Q = 9.89, df = 3, p < .05). Sensation seeking (r =.36) had the largest effect.

Moderation analyses—Because the effect size magnitude varied significantly across studies, we tested a series of variables to be able to explain these differences, via categorical and continuous moderator analyses using SPSS 19.0 and macros provided by Wilson (2010). First, sex, age, race, and clinical status of the sample were examined as continuous moderators using meta-regression. For the overall relationship between impulsivity and alcohol, none of these variables significantly predicted variance in effect size magnitude (sex B = −.01, p = .43, race B = −.01, p = .53, age B = .001, p = .84). Second, we examined study design (correlational vs. group comparison) as a categorical moderator using meta-analysis of variance within the random effects model. Such analyses examined the significance of the $Q(b)$ statistic, which partitions the total variability into portions that were explained by study design and the residual variability as suggested by Lipsey and Wilson (2001). For the overall relationship between alcohol and impulsivity, group design did

moderate the effect sizes found ($Q(b)$ = 6.08, p = .01), in that group comparison studies (n = 9) had stronger effect sizes (Mean effect size = .39, CI = .30–.48, SE = .04) than did correlational studies (n = 85; Mean effect size = .27, CI = .24 – .30, SE = .01). Third, we examined sample type as a categorical moderator of the overall impulsivity and alcohol relationship: it was not a significant predictor: $Q(b)$ = 5.73, p = .33.

Next, we examined how the use of separate alcohol or impulsivity conceptualizations and measures might have affected the magnitude of the effect sizes for the overall relationship and the more specific associations, using a categorical meta-analysis of variance within a random effect model. For the overall relationship between alcohol and impulsivity, although the specific impulsivity construct utilized did moderate the relationship ($Q(b)$ = 10.42, p = .03), the impulsivity measure used did not differentially predict effect size magnitude: $Q(b)$ = 4.51, p = .61. Lack of perseverance had a mean effect size of .34 (SE = .03, CI = .29–.40), positive urgency had a mean effect size of .26 (SE = .06, CI = .14 – .37), negative urgency had a mean effect size of .26 (SE = .03, CI = .19 – .32), lack of planning had an effect size of .24 (SE = .02, CI = .20 – .29), and sensation seeking had a mean effect size of .24 (SE = .03, CI = .19 – .29). Neither the type of alcohol outcome assessed ($Q(b)$ = 4.01, p = .55) nor the specific alcohol measure used ($Q(b)$ = 16.49 p = .17) significantly predicted effect size magnitude.

Discussion

Overall, the study showed support for a relationship between impulsivity and alcohol use. More specifically, however, the magnitude of the effect appears to vary significantly across type of UPPS impulsivity construct assessed. Examination of the data suggests that the overall effect size likely represented several effects of varying magnitude between specific impulsivity-related traits and alcohol outcomes, which were averaged together. Some of this variability in this general association was partly explained by further examining the specific conceptualization of the impulsivity trait and the alcohol outcome.

As hypothesized, the specific UPPS traits showed differential patterns of effect sizes in the prediction of specific alcohol use outcomes. For drinking quantity, the largest effect size was found for lack of perseverance, but this effect was still medium in magnitude. All traits equally predicted drinking frequency, with a medium range effect size. For alcohol dependence, negative urgency and lack of planning had the strongest effects, and were approaching a large magnitude. However, for problematic alcohol consumption, negative and positive urgency had the largest effects, with both effect sizes approaching a large magnitude. Finally, sensation seeking had the largest effect size for binge drinking, and approached a large magnitude.

Interestingly, study demographics and specific assessment measure utilized did not moderate overall effect size between impulsivity and alcohol use. This finding is consistent with recent research, which failed to find sex as a moderator of the relationship between specific impulsivity-related traits and risk outcomes (Cyders, 2011). Interestingly, although the specific impulsivity construct conceptualized did significantly predict differences in effect size magnitude, the method by which the traits are measured does not differentially predict effect size magnitude, offering further support for the UPPS model as a valid method by which to assess impulsivity trait across different studies utilizing the included impulsivity measures, and effect size patterns are not specific to only studies utilizing the UPPS measure. Neither alcohol construct nor alcohol measure significantly moderated the overall relationship.

In general, these findings support the overall study hypothesis that there is a range in the magnitudes of the effects between impulsivity traits and specific alcohol outcomes. Whereas some associations approached large relationships, such as the association between negative urgency and problematic alcohol consumption, other relationships were small in nature, such as the relationship between negative urgency and binge drinking. When these are averaged, it is not surprising that small to medium effect sizes are often found, as effects are masked or reduced by other small or non-significant effects (e.g., Smith et al., 2003). Additionally, given the current findings that the conceptualization of the specific impulsivity-related traits and alcohol outcome both influenced the size of the association, it is not surprising that individual studies report ranges of effect sizes, from small to large, depending on how impulsivity and alcohol use are conceptualized in a particular study. The findings of the current study concerning these different patterns of effect sizes across impulsivity constructs and alcohol outcomes can help inform future research and treatment approaches. Cumulative science on the effects of impulsivity on alcohol use, addiction, and abuse suggest differential roles for separate impulsivity-related traits with specific aspects of alcohol use.

Research Implications

As mentioned above, previous research reported various effect sizes, which are in part due to differences in measurement concerning both how personality traits and alcohol variables are defined and measured. The relationship between impulsivity and alcohol use outcomes depends on the conceptualization of both (1) the specific impulsivity-related trait and (2) the specific aspect of alcohol use. When separate impulsivity-related traits and different underlying aspects of alcohol use are studied, what initially appears to be a small effect can be disaggregated into several relationships of differing magnitudes. It thus seems crucial for researchers to specify precisely their target traits and drinking behaviors in order to study prediction accurately (as also suggested by Cyders and Coskunpinar, 2011). The UPPS model, as well as the drinking outcome separations, utilized in the current study, are two possible ways to do so.

The current study provides estimates of effect sizes concerning the relationship among separate impulsivity-related traits and specific alcohol outcomes, which can inform future research hypotheses concerning these relationships. This is a useful venture, especially in theory design, power estimation, and measure selection stages of research. The current study supports both the importance of defining specific traits more precisely and movements to end reference to a general trait known as “impulsivity” (see Cyders and Coskunpinar, 2011; Cyders and Smith, 2007; 2008; Smith et al., 2007). Instead, there appear to be discrete impulsivity-related traits that have different relationships with different alcohol outcomes. Use of multiple different traits and referring to them all as “impulsivity” will likely lead to small effects, whereas use of more specific and discrete impulsivity traits will reveal different relationship magnitudes with outcomes of interest.

Additionally, researchers should be cautious in combining multiple aspects of alcohol use into a multidimensional measure, as this could mask important relationship patterns. Although the conceptualizations for the alcohol outcomes used in the current study were not as well-developed as those used for the impulsivity-related traits, the current study suggests that the constructs of alcohol frequency, alcohol quantity, alcohol abuse, alcohol dependence, binge drinking, problematic alcohol consumption, and drinking onset could be useful terms to use when describing underlying dimensions of alcohol use that could show discrete associations with risk factors. Future research should take action to separate these behaviors into reliably measured dimensions and thus to operationalize them in ways that can clarify the risk process for different aspects of alcohol consumption. Clearly, the valid separation of alcohol use into these aspects is an ongoing enterprise and future research should seek to further validate these distinctions and should consider other possible markers

for alcohol use. It might also prove useful to separate other risk behaviors, such as drug use or risky sexual practices, into specific outcome variables.

This study also highlights where further research is needed in examining the relationship between discrete impulsive traits and alcohol outcomes. There seems to be a lack of research in examining binge drinking, age of onset, and alcohol abuse with specific impulsivity-related traits, especially with positive urgency; therefore, these relationships should be further examined.

Clinical Implications

Based on the current study findings, clinical practice might consider interventions that differentially target traits based on the level of intervention. For instance, if attempting to mitigate problems associated with alcohol use or alcohol dependence, positive and negative urgency traits appear to be the most likely points of prevention (although it is important to note that no studies have examined how positive urgency relates to alcohol dependence, although future research should address the validity of such an approach empirically). Although existing treatment methods and some preliminary research suggests treatment matching specific impulsivity-related traits, the fact is that although we might know where to intervene to prevent some of these more specific alcohol outcomes, there is not yet consensus on the best method in which to intervene on these traits. Existing public service advertisements targeting sensation seeking as a mechanism for drug and alcohol use (see Palmgreen et al., 2001) and a more recent attempt, which aims to develop mood management and goal attainment skills in children aged nine to 14 years to prevent future risk-taking behaviors (targeting the urgency traits; Zapolski et al., 2010) are two such successful attempts. Continued research in this area is warranted.

Limitations

The file drawer problem (Rosenthal, 1979) applies to the current study, and could contribute to inflated effect size calculations; however, the fail-safe *N* analyses suggest robust effects for many associations, although some associations that were based on fewer studies had low fail-safe *N* values and thus should be seen as more provisional hypotheses. Second, many relationships could not be examined due to lack of existing research, such as the relationship between positive urgency and binge drinking, and thus these relationships should be studied in future research. Third, the current study does not consider the relationships among behavioral lab tasks of disinhibition and alcohol use, which should be examined further. Fourth, many of the reviewed studies were cross-sectional and thus certainty regarding relationships in individual cross-sectional studies should be provisional; however, convergence across multiple cross-sectional studies does increase the confidence in the current findings. Fifth, the disaggregation of alcohol constructs was not as well developed as the disaggregation of the impulsivity constructs, and it is likely that the differences in the alcohol constructs could affect the calculated effect sizes; however, in the current study, alcohol construct or measure did not predict differential effect sizes. Additionally, these constructs were chosen from reported study definitions to represent clinically useful constructs related to alcohol use that are currently being measured in the research literature. These categorizations should be researched more fully.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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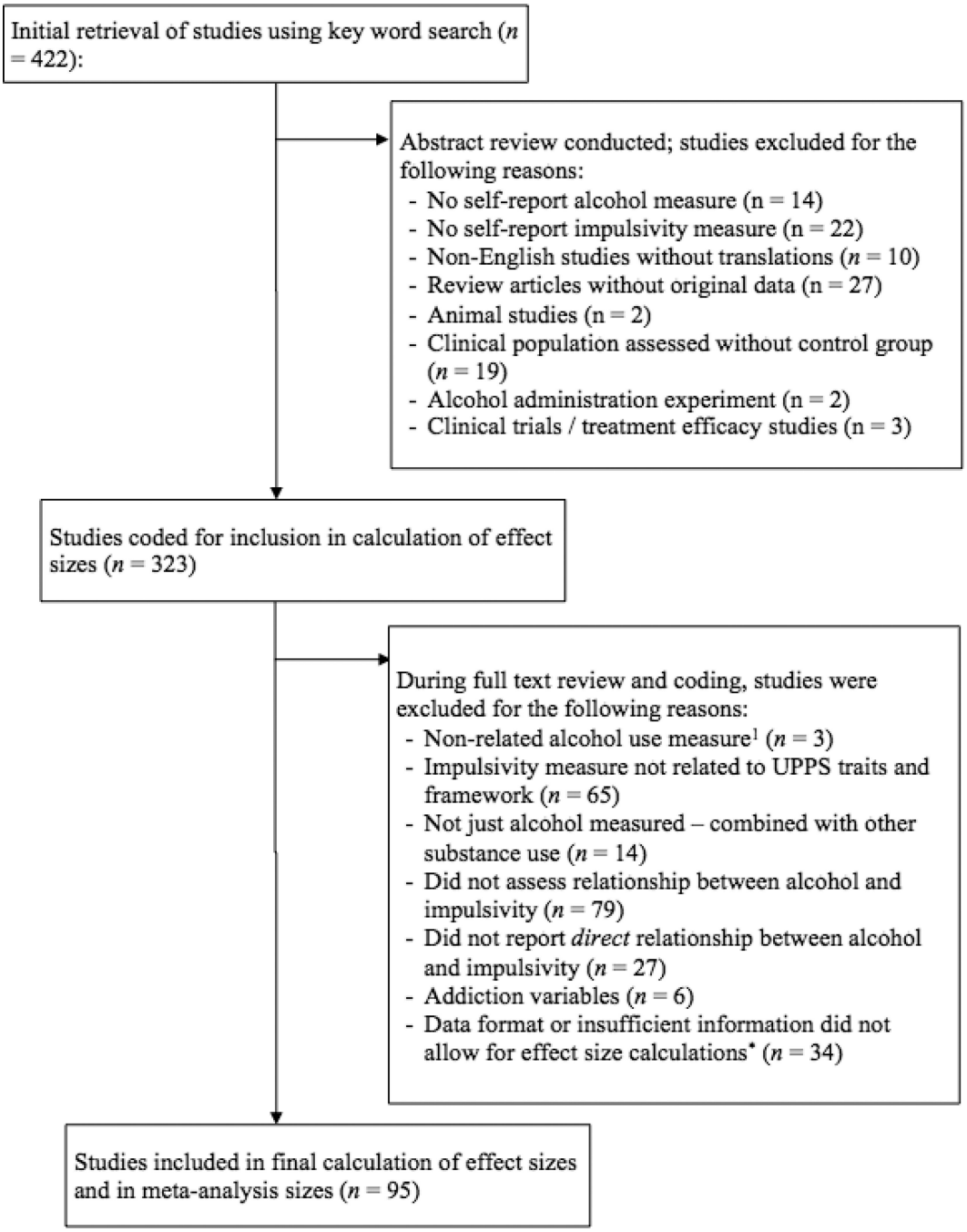

Figure 1.
Flow chart for selection of studies used in meta-analysis calculations. *Authors were emailed to obtain more data to calculate effect sizes and received responses from 7 authors.

Table 1

Separation of Impulsivity into Theoretical Categorizations

Disposition	Measure	Reference*
Lack of planning	NEO-PI-R deliberation scale	Costa and McCrae (1992)
	Multidimensional Personality Questionnaire control scale	Tellegen (1982)
	Personality Research Form impulsivity scale	Jackson (1984)
	Eysenck's I-7 impulsivity scale	Eysenck et al. (1985)
	Temperament and Character Inventory impulsivity scale	Cloninger (1987)
	Buss and Plomin's decision time scale	Buss and Plomin (1975)
	Barratt's lack of planning and motor impulsivity scales	Patton et al. (1995)
	Barratt's attentional impulsivity	Patton et al. (1995)
	UPPS	Whiteside and Lynam (2001)
	Differential Personality Inventory	Jackson and Messick (1971)
Lack of perseverance	NEO-PI-R self-discipline scale	Costa and McCrae (1992)
	Sensation Seeking Scale disinhibition and boredom susceptibility	Zuckerman (1994)
	Buss and Plomin's persistence scale	Buss and Plomin (1975)
	UPPS	Whiteside and Lynam, 2001
Sensation seeking	Sensation Seeking Scale, thrill and adventure seeking	Zuckerman et al. (1964)
	Buss and Plomin's sensation seeking scale	Buss and Plomin (1975)
	Eysenck's venturesomeness scale	Eysenck et al. (1985)
	NEO-PI-R excitement seeking scale	Costa and McCrae (1992)
	Dickman's functional impulsivity scale	Dickman (1990)
	UPPS	Whiteside and Lynam (2001)
Negative urgency	Inhibitory control	Buss and Plomin (1975)
	NEO-PI-R impulsiveness scale	Costa and McCrae (1992)
	Barratt's attentional impulsivity	Patton, Stanford and Barratt (1995)
	UPPS	Whiteside and Lynam (2001)
Positive urgency	UPPS-P	Lynam, Smith, Whiteside, and Cyders (2006)

Note. Table reproduced in part from Dick et al. (2010) with author permission.

*Full citations for these references are included in the supplemental online materials.

Table 2

Measurement of Drinking Constructs

Drinking	Measure	Reference*
Quantity	Personal drinking habits	Balodis et al. (2007)
	Semi-structured genetics of alcoholism (SSAGA)	Bucholz et al. (1994)
	Drinking styles questionnaire (DSQ)	Smith, McCarthy, and Goldman (1995)
	Adolescent alcohol involvement scale	Mayer and Filstead (1979)
	Quantity-frequency variability index (QFV Index)	Lemmens et al. (1992)
	Quantity/frequency of recent drinking scale	Hesselbrock et al. (1983)
	The alcohol use disorders identification test	Babor et al. (2001)
	Alcohol questionnaire	Kaprio et al. (1987)
	Health habits questionnaire	Grau and Ortet (1999)
	AIS	Grau and Ortet (1999)
	Quantity/frequency alcohol use questionnaire (Cahalan drinking habits questionnaire)	Cahalan et al. (1969)
	Self-report alcohol use questions	Wood, Nagoshi, and Dennis (1992)
	Decisional balance inventory	Migneault et al. (1997)
	Daily drinking questionnaire	Collins, Parks, and Marlatt (1985)
	Timeline follow back	Sobell and Sobell (1992)
	Alcohol purchase task	Murphy and MacKillop (2006)
Frequency	Timeline follow back	Sobell and Sobell (1992)
	Personal drinking habits	Balodis et al. (2007)
	Drinking styles questionnaire (DSQ)	Smith, McCarthy, and Goldman (1995)
	Adolescent alcohol involvement scale	Mayer and Filstead (1979)
	Semi-structured genetics of alcoholism (SSAGA)	Bucholz et al. (1994)
	Quantity-frequency variability index (QFV Index)	Lemmens (1992)
	Quantity/frequency of recent drinking scale	Hesselbrock et al. (1983)
	Health habits questionnaire	Grau et al. (1999)
	Short alcohol dependence data questionnaire	Davidson & Raistrick (1986)
	Self-report alcohol use questions	Wood, Nagoshi, & Dennis (1992)
	Decisional balance inventory	Migneault et al. (1997)
	The alcohol use disorders identification test	Babor et al. (2001)
	The cognitive appraisal of risky events questionnaire	Fromme et al. (1997)
Abuse	DSM	APA (2000)
	Semi-structured genetics of alcoholism (SSAGA)	Bucholz et al. (1994)
	Michigan alcoholism screening test	Selzer et al. (1975)
	DMQ revised	Novak et al. (2000)
Dependence	DSM	APA (2000)
	The alcohol use disorders identification test	Babor et al. (2001)
	Severity of alcohol dependence questionnaire (SADQ)	Stockwell et al. (1979)
	Michigan alcoholism screening test	Selzer et al. (1975)
	Short alcohol dependence data questionnaire	Davidson and Raistrick (1986)
	Comprehensive drinker profile	Miller and Marlatt (1984)

Drinking	Measure	Reference*
Problematic	The alcohol use disorders identification test	Babor et al. (2001)
	ASSIST	Ali et al. (2002)
	Addiction severity index	McLellan et al. (1997)
	Michigan alcoholism screening test	Selzer et al. (1975)
	Drinking styles questionnaire (DSQ)	Smith, McCarthy, and Goldman (1995)
	Rutger's alcohol related problem index	White and Labouvie (1989)
	Self-report alcohol use questions	Wood, Nagoshi, and Dennis (1992)
	Semi-structured genetics of alcoholism (SSAGA)	Bucholz et al. (1994)
	College alcohol problems scale	Maddock et al. (2001)
	Alcohol consequences questionnaire	Kahler et al. (2005)
	Brief young adult alcohol consequences questionnaire	Kahler et al. (2005)
Binge	Alcohol use questionnaire	Mehrabian and Russell (1978)
Use	DSM	
	College alcohol problems scale-revised (CAPSr)	Maddock et al. (2001)
	CDC youth risk behavior surveillance system (YRBSS)	CDC (2001)
	Drinking styles questionnaire (DSQ)	Smith, McCarthy, and Goldman (1995)
	Quantity-frequency variability index (QFV Index)	Lemmens (1992)
	The alcohol use disorders identification test	Babor et al. (2001)
	10-item alcohol questionnaire	Hair and Hampson (2006)
	Australian AusAUDIT	Degenhardt et al. (2001)
	Short alcohol dependence data questionnaire	Davidson and Raistrick (1986)
	Quantity/frequency alcohol use questionnaire (Cahalan drinking habits questionnaire)	Cahalan et al. (1969)

Note.

*Full citations for these references are included in the supplemental online materials.

Table 4

Mean Effect Sizes and Q-test of homogeneity for Each Association

Alcohol Construct	Impulsivity Trait	K	N	ES	95% CI	Z	SE	Fail-safe N
All	All	96	38168	.28	.25–.30	21.06**	.01	178
Quant	SS	13	3342	.21	.13–.29	5.38**	.04	17
Quant	**LPS**	16	10202	**.32**	.25–.38	9.64**	.03	33
Quant	LPL	15	3330	.21	.17–.25	10.02**	.02	20
Quant	NUR	10	2566	.17	.13–.21	7.67**	.02	10
Quant	PUR	-	-	-	-	-	-	-
Freq	SS	14	4904	.22	.17–.27	8.55**	.03**	20
Freq	LPS	20	8065	.28	.21–.25	7.96**	.04	36
Freq	LPL	11	2911	.21	.17–.26	9.59**	.02	14
Freq	NUR	4	1066	.22	.07–.37	2.90*	.08	5
Freq	PUR	-	-	-	-	-	-	-
Depend	SS	8	2171	.22	.17–.27	8.48**	.03	11
Depend	LPS	3	1595	.23	.11–.35	3.84**	.06	4
Depend	**LPL**	8	2681	**.37**	.26–.49	6.43**	.06	19
Depend	**NUR**	5	2381	**.38**	.29–.47	8.30**	.04	12
Depend	PUR	-	-	-	-	-	-	-
Problems	SS	8	1811	.17	.08–.26	3.78**	.05	8
Problems	LPS	11	4589	.27	.19–.36	6.32**	.04	19
Problems	LPL	25	8811	.26	.21–.31	11.21**	.02	42
Problems	**NUR**	17	5707	**.34**	.30–.38	15.54**	.02	38
Problems	**PUR**	5	1278	**.34**	.28–.40	11.23**	.03	10
Binge	**SS**	5	996	**.36**	.14–.58	3.26**	.11	11
Binge	LPS	4	1356	.22	.12–.33	4.22**	.05	5
Binge	LPL	5	2670	.23	.19–.27	11.76**	.02	7

Alcohol Construct	Impulsivity Trait	K	N	ES	95% CI	Z	SE	Fail-safe N
Binge	NUR	5	1134	.13	.07–.19	4.37**	.03	3
Binge	PUR	-	-	-	-	-	-	-
Use	SS	11	3120	.27	.19–.36	6.24**	.04	19
Use	LPS	15	4647	.32	.23–.41	7.13**	.05	31
Use	LPL	11	3973	.27	.21–.33	9.12**	.03	19
Use	NUR	7	2092	.29	.20–.39	6.14**	.05	13
Use	PUR	3	1273	.29	.15–.43	3.92**	.08	5

Note.

*$p < .05$;

**$p < .001$; - denotes that fewer than two studies examined this association and thus no statistics could be calculated. BOLD denotes that the effect size is the significantly largest effect size for the specific drinking outcome; where more than one are bolded for a specific drinking outcomes, these effect sizes were larger than the remaining effect sizes; where no are bolded for a specific drinking outcomes, the effect sizes did not differ significant from each other. See the text for values of the Q-test comparison and follow-up z tests.