Avens Publishing Group
J Addiction Prevention
September 2013 Vol.:1, Issue:2

The Role of Impulsivity, Anger, Verbal Ability, and Abstract Reasoning in Emerging Adults' Treatment Outcomes

Open Access Short Communication

Journal of Addiction & Prevention

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Submission: 13 August 2013
Accepted: 06 September 2013
Published: 16 September 2013

Keywords: Alcohol; Motivational interviewing; Verbal ability; Anger; Impulsivity

Abstract

Motivational interviewing (MI), a brief, client-centered intervention, has shown promise in reducing problem drinking. However, many questions remain regarding how to improve effectiveness of this intervention. Based on prior work indicating the importance of individual difference factors in response to MI interventions, this study explicitly evaluated the influence of empirically-indicated and theoretically-indicated individual difference factors (i.e., impulsivity, anger, verbal ability, abstract reasoning) in predicting treatment response. The sample included 53 problem drinkers (58.5% female; 54.9% Caucasian; 29.4% Hispanic; M age = 20.02 years). Multiple regression analyses indicated that verbal ability, anger, and impulsivity predicted reductions in quantity of drinking (drinks per drinking day) at the one month follow-up. Specifically, we observed a three-way interaction between verbal ability, anger, and impulsivity, whereby youth with either high or low verbal ability benefitted from treatment, with anger and impulsivity serving as limiting factors. Together, these data highlight the complex relationship between salient and indicated individual difference factors (impulsivity, anger, abstract reasoning, and verbal ability) in terms of treatment outcomes, as well as the relevance of examining these relationships directly with younger samples.

Introduction

Across the lifespan, emerging adults (age 18-25) have the highest rates of hazardous drinking, with as many as 71% using alcohol, 49% engaging in binge drinking (4+ drinks per episode/females, and 5+ drinks per episode/males; [1], and 31% meeting criteria for alcohol use disorders [2]. While these rates are alarming, they are not a new trend; the rates of hazardous drinking among this age group have maintained historical consistency throughout the past five decades [3,4].

In contrast with older adults' drinking patterns, emerging adult drinking does not tend to cause harm through consistent, steady rates of excess. Rather, emerging adult problem drinking frequently manifests itself as "dumb drinking" [5], single occasions of excessive consumption that lead to sadly irrevocable outcomes, such as the accidents, injuries, and fatalities that may result from drinking and driving. Moreover, emerging drinking not only affects the drinker, but often the entire community, resulting in increased levels of property damage, sexual assault, and interpersonal victimization [6].

Similar to adolescents [e.g., 7], emerging adults do not tend to be treatment-seeking. Rather, despite the prevalence of alcohol use disorders in this age group, few emerging adults receive needed interventions [8]. The rare receipt of treatment persists despite the generally positive outcomes observed for emerging adults across brief interventions, particularly those that permit youths' ambivalence around changing their behavior (e.g., motivational interviewing; MI; [9,10]). While MI shows promise for this age group, the small (d=0.16) to medium (d=0.67) effect sizes found across MI (e.g., [11])indicate the need to explore potential contributing individual difference factors in order to guide and improve treatment effectiveness.

Salient individual difference factors

Several individual difference factors have been linked to risk for problem drinking, as well as treatment response. However, few studies have coordinated examinations of these individual difference factors with emerging adults. To that end, impulsivity (e.g., [12,13]) and anger (e.g., [14]) have been linked to greater rates of problem drinking and poorer treatment outcomes throughout the broader addictions literature. In the context of MI, emerging adults with lower levels of impulsivity have responded better to MI interventions [15]. In addition, results from Project MATCH indicated that adults high in anger reported better treatment outcomes with MI (more days abstinent and fewer drinks per drinking day) [16].

In terms of relevant neuropsychological factors, verbal ability and abstract reasoning have also been implicated in treatment response. In general, lower verbal ability has been associated with greater alcohol problems [17], and difficulties with abstract reasoning have been associated with greater alcohol use [18]. Further, while it has not been previously examined, some suggest that individuals with greater verbal ability may be more likely to respond to talk-based treatments like MI, as they may be better able to access and utilize language to describe their feelings and emotions, as required in MI interventions [19]. Similarly, individuals with greater abstract reasoning skills may respond better to MI, as they may be better able to engage in some of the requisite tasks, including simultaneously considering one's own behavior and how that behavior fits with one's goals [20].

This study sought to build upon and extend previous work by

ISSN: 2330-2178

utilizing an integrative approach (behavioral with neuropsychological) to evaluate salient individual difference factors that may modulate response to a psychosocial alcohol intervention (MI). Based on the literature, it was hypothesized that greater levels of impulsivity and anger would be related to poorer MI outcomes (smaller reductions in post-treatment drinking). In addition, we predicted that greater verbal ability and abstract reasoning would result in better MI outcomes (larger reductions in follow-up drinking).

Materials and Methods

Participants

Following other studies with young drinkers, introductory psychology students were invited to participate in return for class credit [21]. All study procedures were approved by the university institutional review board and conducted with a federal Certificate of Confidentiality. Participants were required to be ages 18 to 25 (e.g., [22,23]), report current binge drinking (≥4 past month binge drinking episodes, defined as ≥4 drinks/occasion for females; ≥5 drinks/occasion for men) [23], provide written consent, evidence a breath alcohol level of 0 prior to all study components, and meet fMRI safety criteria (for the parent study)(e.g., [24]). Participants received $60 for participation.

Procedures

This study was part of a larger investigation (PI: first author). For this component of the evaluation, participants completed a psychosocial and neuropsychological assessment, two MI sessions focused on reducing binge drinking and a behavioral follow-up at one month. All individuals completed the assessment and the first MI session during their first appointment. One week later, all participants completed their second MI session. One month after the second MI, all participants completed their final behavioral follow-up.

Measures

At the assessment session, participants completed measures of demographics, alcohol use, and individual difference factors. Past month alcohol use (drinks per drinking day; DDD) was evaluated using the Time Line Follow-Back Interview (TLFB; [25]) at both the initial assessment and the one-month follow-up. Change scores were calculated by subtracting their initial average DDD reported from the follow-up average DDD, and multiplying that number by -1 (so that higher scores indicated greater drinking reductions). In terms of individual difference factors, we evaluated impulsivity with the Impulsive Sensation Seeking scale (ImpSS; [26]), a nineteen item, dichotomous self-report measure. Anger was measured using the State-Trait Anger Expression Inventory – 2 Children & Adolescents (STAXI-2 C/A; 27), a thirty-five item self-report measure using a three-point Likert scale. Finally, to assess our proposed neuropsychological factors, participants were administered vocabulary (verbal ability) and matrix reasoning (abstract reasoning) subtests of the Wechsler Abbreviated Scale of Intelligence (WASI; [28]).

Results

This sample (N = 53; 58.5% female; M age = 20.02, *SD* = 1.90) was ethnically diverse (54.9% of participants self identified as Caucasian, 29.4% Hispanic, 2.0% African-American, 2.0% Asian, 2.0% Native-American, and 9.8% bi- or multi-racial).

Individual difference factors and treatment response

Two distinct multiple regression analyses were used to examine the contribution of impulsivity, anger, verbal ability, and abstract reasoning in predicting post-treatment changes in drinks per drinking day (DDD). Regression analysis was performed using the PROCESS macro [29] in SPSS. The results of these regression analyses are presented in Table 1. As expected, scores for verbal ability and abstract reasoning were correlated ($r = 0.35$, $p = 0.015$).

In the first regression analysis, post-treatment changes in DDD were regressed on verbal ability, anger, impulsivity, and their interactions. This set of predictors accounted for 46.9% of the variance in post-treatment changes in DDD [$F_{(7,33)} = 4.16$, $p = 0.0022$]. In this analysis, impulsivity was predictive of changes in drinking behavior ($b = 56.07$, SE = 18.36, $t(40) = 3.05$, $p = 0.0044$). Neither verbal ability ($b = 2.77$, $t(40) = 1.73$, $p = 0.12$) nor anger ($b = 8.79$, $t(40) = 1.03$, $p = 0.31$) were significant direct predictors of post-treatment changes in DDD. However, the anger × verbal ability × impulsivity interaction was a significant predictor of post-intervention reductions in DDD ($F_{(1,33)} = 7.64$, R^2 change = 0.12, $p = 0.009$). Among participants with lower verbal ability, those with both low anger and high impulsivity showed greater reductions in drinking than did those with high anger and low impulsivity. Among participants with high verbal ability, those with both high anger and high impulsivity had greater reductions in drinking than did those with either high anger and low impulsivity or low anger and high impulsivity (see Figure 1).

Table 1: Bivariate regressions of individual difference factors (impulsivity, anger, verbal ability, and abstract reasoning) and their interaction with post-treatment alcohol use outcomes (reduction in drinks per drinking day).

Independent Variable	*B*	SE *B*	*t*
Verbal Ability			
Constant	-105.14	88.70	
Verbal Ability	2.77	1.73	1.59
Impulsivity	56.07	18.36	3.04**
Anger	8.79	8.53	1.03
VERBAL ABILITY × IMPULSIVITY	-1.22	0.42	-2.92**
VERBAL ABILITY × ANGER	-0.25	0.17	-1.45**
IMPULSIVITY × ANGER	-4.99	1.74	-2.86**
VERBAL ABILITY × ANGER × IMPULSIVITY	0.11	0.04	2.76**
Note. $R^2 = .469$ ($p < .01$)			
Abstract Reasoning			
Constant	236.14	127.75	
Abstract Reasoning	-3.69	2.04	-1.81
Impulsivity	-53.53	30.69	-1.74
Anger	-24.79	12.60	-1.97
ABSTRACT REASONING × IMPULSIVITY	0.86	0.49	1.78
ABSTRACT REASONING × ANGER	0.39	0.20	1.95
IMPULSIVITY × ANGER	5.76	3.02	1.91
ABSTRACT REASONING × ANGER × IMPULSIVITY	-0.90	0.04	-1.97
Note. $R^2 = .423$ ($p < .01$)			

ISSN: 2330-2178

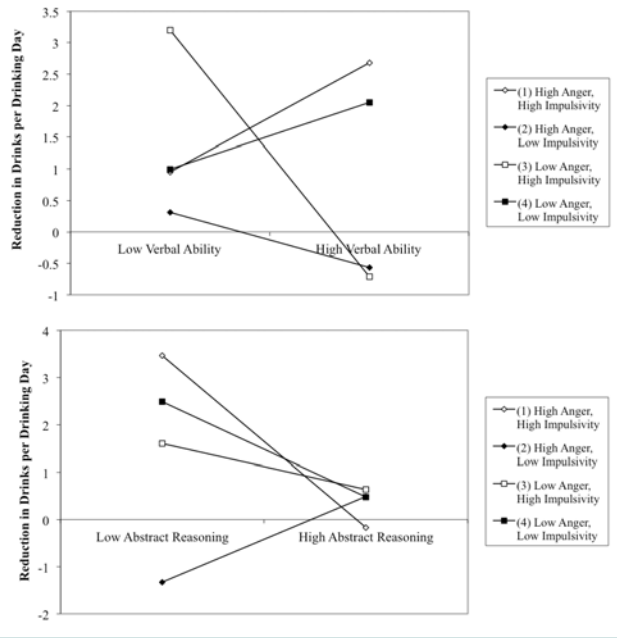

Figure 1: Moderating effects of anger and impulsivity on the relationship between verbal ability (top) and abstract reasoning (bottom) and post-treatment alcohol use outcomes (reduction in drinks per drinking day).

In the second regression analysis, post-intervention changes in DDD were regressed on abstract reasoning, anger, impulsivity, and their interactions. This set of predictors accounted for 42.3% of the variance in post-intervention changes in DDD [$F_{(7,33)}$ = 3.45, p = 0.0069]. In this analysis, neither abstract reasoning (b = -3.69, $t(40)$= -1.81, p =0.08), nor impulsivity (b = -53.53, $t(40)$ = -1.74, p = 0.09), nor anger (b = -24.79, $t(40)$= -1.97, p = 0.06) were significant direct predictors of post-intervention changes in DDD, nor was the anger × abstract reasoning ×impulsivity interaction ($F_{1,33}$ = 3.88, R^2 change = 0.07, p = 0.06) predictive of treatment response.

Discussion

This study offered an opportunity to examine salient individual difference factors and their relationship to young drinkers' response to a widely-disseminated brief intervention, motivational interviewing (MI) [10]. Examination of individual difference factors is important as it provides an opportunity to evaluate individual-level constructs that may influence not only MI intervention response, but also the persistence of alcohol use behaviors (e.g., [30]). Based on prior work, we were particularly interested in the potential influence of empirically- and theoretically-indicated individual difference factors (e.g., impulsivity, anger, verbal ability, abstract reasoning), and their relationships with post-treatment changes in alcohol use behavior (drinkers per drinking day). Based on prior work, we hypothesized that greater levels of impulsivity and anger would be related to smaller reductions in drinking [15,16]. And, higher verbal ability and abstract reasoning would result in better MI outcomes (larger reductions in post-treatment drinking) (e.g., [19,20]).

In contrast with predictions, our results were slightly more complicated than anticipated. To that end, we found that verbal ability, anger, and impulsivity predicted better treatment outcomes at the one month follow-up (significant reductions in drinks per drinking day). To that end, youth with both high and low verbal ability benefitted from treatment, with anger and impulsivity serving as limiting factors. In other words, we found that youth who had lower verbal ability, lower anger, and higher impulsivity showed better treatment outcomes in this MI intervention. Similarly, youth with higher verbal ability, higher anger and higher impulsivity performed well in this treatment approach.

These findings are clinically relevant, as despite predictions that high levels of verbal ability might be needed for positive MI treatment outcomes, in this study youth with a range of verbal ability showed positive treatment outcomes (reductions in drinking behavior). This stands in contrast to prior studies, which have suggested that youth might need to have a certain level of verbal development in order to be able to actively participate in an MI session [31]. Our findings indicate that, youth may be able to participate in, and benefit from MI regardless of their level of verbal ability. However, it is important to note that other factors, specifically anger and impulsivity, moderated this treatment response.

To that end, while previous work has suggested that individuals high in anger may uniquely respond to the empathic and non-judgmental approach of MI (e.g., [16,32]), we found that anger did not directly predict post-treatment reductions in drinking. Rather, youth with both lower levels of anger (and low verbal ability/high impulsivity), as well as higher levels of anger (and high verbal ability/ impulsivity) reported greater post-treatment change. This suggests that anger may be a contributing, and slightly more complicated, factor in MI treatment response for young drinkers. These results are in line with other developmental studies in MI [33,34], which have found that factors important in adult MI treatment response do not directly map on to youth treatment response patterns. Further, these developmental studies highlight the importance of explicitly evaluating salient active ingredients in MI with younger populations.

Similarly, while prior studies have indicated that impulsivity may interfere with positive MI treatment outcomes(e.g., [15]), our study found the opposite; not only did impulsivity directly predict treatment response (in the context of verbal ability), youth with greater impulsivity demonstrated better treatment outcomes in this MI intervention. There may be several reasons for this. First, a number of studies with high-risk youth and emerging adults have found excellent responses with MI (e.g., [35,36,37]). This is clinically relevant, as younger populations tend toward higher levels of impulsivity (e.g., [38]). Thus, it may be the case that MI provides a context wherein even developmentally-appropriate impulsive individuals can stop and consider their problematic drinking patterns, subsequently resulting in greater than expected reductions in drinking.

In addition, while prior studies have indicated that abstract reasoning skills may help facilitate youths' ability to engage in, and respond to MI (e.g., [19]),we found no relationship between level of abstract reasoning and MI treatment response in this young sample. This finding suggests that youths' ability to contemplate and consider hypothetical ideas, as is requisite in many MI sessions, may not be important to MI response in this age group. It is equally possible that our measure of abstract reasoning may not have been the best instrument to tap into these cognitive skills. Future work in our lab will assess whether alternative measures of abstract reasoning, such as the Ravens [39], or even measures of theory of mind [40], may better access this construct and related treatment outcomes with youth.

ISSN: 2330-2178

Ultimately, in terms of clinical implications, this study suggests that the following factors are important to consider when contemplating whether to conduct MI with young drinkers. Across the board, youth responded well to this intervention. Further, this intervention appeared to be a particularly good fit for youth with high levels of impulsivity, all levels of verbal ability (high and low), and all levels of anger (high and low). At this time, our data does not suggest that abstract reasoning should be included in decisions about whether or not to conduct MI with this age group.

This study has several strengths, including utilization of an integrative (behavioral with neuropsychological) measurement approach to evaluate predictors of treatment response in an MI intervention with a diverse sample of young drinkers. However, it is important to consider these findings in light of the following limitations. First, all participants were recruited from a university setting; future work must be done to evaluate outcomes in a community-based sample. Second, the results were detected in a relatively small sample; thus, it will be important to replicate these results with a larger sample. Third, this study relied on behavioral and neuropsychological measures of individual differences. Re-examination with other approaches, such as functional neuroimaging (e.g., fMRI), would strengthen the observed results. Fourth, without a control group, it is not possible at this time to evaluate how much and whether the observed improvements reflect regression to the mean.

Ultimately, our results suggest the promise of MI, as well as the critical and complex contributing role of salient individual difference factors in intervention response. These findings indicate the importance of continuing to apply multi-level and integrative approaches to examine response to MI using multiple methodologies across developmental groups [33,34].

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ISSN: 2330-2178

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Acknowledgements

This study was supported by DE-FG02-08ER64581, PI: Feldstein Ewing. The authors would like to thank Liana Rivera BA, Lindsay Chandler BA, Shirley Smith MS, Tom Chavez MA, and Erin Tooley MS, for their assistance with this study.