HHS Public Access

Author manuscript

Alcohol Clin Exp Res. Author manuscript; available in PMC 2021 January 01.

Published in final edited form as:

Alcohol Clin Exp Res. 2020 January ; 44(1): 233–243. doi:10.1111/acer.14237.

Growth Mindsets of Alcoholism Buffer Against Deleterious Effects of Drinking Identity on Problem Drinking Over Time

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Abstract

Background: Explicit (self-report) and implicit (indirect) measures of identification with drinking alcohol – drinking identity – are associated with drinking outcomes cross-sectionally and longitudinally. A key next step is to identify moderators. The current study evaluated a promising moderator: mindsets of alcoholism. Believing people can change (growth mindset) is associated with adaptive outcomes in domains such as mental health, but research is scant regarding mindsets related to problematic drinking. We evaluated whether individuals' alcoholism mindsets moderated the drinking identity to drinking relation as part of a larger, longitudinal web-based study of heavy drinkers.

Methods: 422 US college graduates (59% women) who were heavy drinkers completed measures assessing drinking identity, mindsets, and drinking outcomes (consumption, problems, risk of alcohol use disorder). Drinking outcomes were assessed at two subsequent assessments occurring 4 months and 8 months after the initial assessment.

Results: Drinking identity was positively associated with drinking outcomes, and drinking outcomes reduced following college graduation. Alcoholism mindsets were significantly and negatively correlated with all drinking outcomes. Mindsets were only conditionally associated with drinking behaviors over time in models that evaluated mindsets, drinking identity measures, and their interaction. Mindsets moderated the relationship between drinking identity and changes in drinking behaviors, but the relation was specific to explicit drinking identity and consumption. Among participants with stronger drinking identity, those who had stronger (vs. weaker) growth mindsets reported reduction in consumption over time.

Conclusions: Growth mindsets of alcoholism appear adaptive for college graduate heavy drinkers with a stronger drinking identity. Mindsets are amenable to interventions; targeting them may be useful in heavy drinking college graduates.

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Keywords

drinking identity; growth mindsets; hazardous drinking; implicit theories

Introduction

Drinking identity—or the extent to which individuals associate themselves with drinking alcohol—is a robust predictor of drinking outcomes among US adolescents (Lee et al., 2018, 2015b, 2015b), US college students (Casey and Dollinger, 2007; Gray et al., 2011; Lindgren et al., 2016c, 2013), and a broader age-range of US adults (Corte and Stein, 2007; Lindgren et al., 2016a; Montes et al., 2017). An important next step is to identify moderators, especially moderators that may attenuate the relation between identity and drinking over time and that are potentially malleable. One theoretically-rich and empirically-supported moderator in other health behavior domains is an individual's belief about the malleability (growth mindset) versus permanent nature (fixed mindset) of human attributes and traits—in this case, problematic drinking. Growth mindsets predict and can help offset the deleterious effects of challenging situations (e.g., Yeager and Dweck, 2012). Similarly, it may be that the risk of greater identification with drinking can be offset by having beliefs that people can change if they have problems with their drinking.

Despite the potential application of mindsets to problematic drinking and substance use, this area of work is emergent and focused on evaluating simple associations with problematic drinking (Schroder et al., 2016) and on substance use treatment intentions (Burnette et al., 2019). In extending this work and merging it with drinking identity theory, we have three goals. First, we seek to replicate the drinking identity to drinking outcome link using both implicit and explicit measures. Second, we examine if growth mindsets directly predict drinking outcomes. Third, we investigate mindsets of problematic drinking as a potential moderator of the drinking identity to drinking outcomes link. We examine these relations in a longitudinal study of recent US college graduate heavy drinkers.

Drinking Identity

In the last 10 years, there is renewed interest in the self and drinking, with relatively consistent findings that measures of drinking identity are is positively associated with drinking outcomes over time, including alcohol consumption, alcohol-related negative consequences, and risk of alcohol use disorder (Corte and Stein, 2007; Gray et al., 2011; Lee et al., 2018; Lindgren et al., 2016c, 2016a, 2013; Montes et al., 2017). Measures of drinking identity also predict variance in drinking outcomes that is distinct from validated psychological constructs that are important predictors of drinking and targets for intervention (Lindgren et al., 2016d), suggesting that measures of drinking identity assess a unique construct. The potential significance of drinking identity is underscored by the plethora of theory and research on the importance of how one sees oneself in cognitive processing, goal-setting, affect regulation, and ultimately, behavior (Markus and Wurf, 1987) as well as by the robust research literature on substance-related identities (for example, smoking: Hertel and Mermelstein, 2012; Shadel and Mermelstein, 1996; Tombor et al., 2013; marijuana: Mostaghim and Hathaway, 2013; Pearson et al., 2017).

Drinking identity can be assessed in multiple ways. Most commonly, it is assessed explicitly by asking participants to self-report the extent to which drinking alcohol is part of or important to their identity (e.g., Corte and Stein, 2007; Lindgren et al., 2013). Drinking identity can also be assessed implicitly or indirectly via reaction time tasks in which one's identification with drinking is inferred based on performance on those tasks (Caudwell and Hagger, 2014; Gray et al., 2011; Lindgren et al., 2013). When evaluated as predictors simultaneously, both types of measures account for unique variance in outcomes. An advantage of using both kinds of assessments is that implicit measures are less subject to self-presentation concerns and may capture a different kind of cognitive construct, namely automatically-activated associations in memory (Lindgren et al., 2018b; Wiers and Gladwin, 2017).

With respect to advancing research on drinking identity, a key next step is to identify and test theory-driven moderators of the relationship between drinking identity and drinking outcomes. Though there has been some research (Foster et al., 2014; Lindgren et al., 2015a, 2014), it is scant, with mixed findings and reliance on cross-sectional studies. Because drinking identity is associated with increases in risk of problematic drinking (Lindgren et al., 2016c), it is important to identify moderators that are associated with greater, faster, or earlier reductions in drinking—mindsets of problematic drinking may represent such a buffer.

Mindsets

Philosophers and psychologists have long recognized the importance of people's lay theories or beliefs for shaping their emotions, thoughts, and behaviors. Building on this tradition, Dweck and colleagues (Dweck and Leggett, 1988) homed in on two specific types of theories: incremental theories, now called growth mindsets, which are beliefs that human attributes are malleable, and entity theories, now referred to as fixed mindsets, which are beliefs that human attributes are stable. Mindsets are distinct from cognitive ability and personality traits such as the Big Five, and they are domain specific. For example, an individual may believe that intelligence can be developed but that musical ability is an innate characteristic. Importantly, mindsets are also theoretically and empirically distinct from self-efficacy, defined as "beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (Bandura, 1997). For example, although one might believe they are a talented musician who has the skills for success (efficacy), they may simultaneously believe that those skills are a result of being gifted (fixed mindset) or a result of working hard (growth mindset). Additionally, empirical work provides evidence for discriminant validity of mindsets and self-efficacy (Dweck et al., 1995). Furthermore, a meta-analysis with 13,709 participants shows only a small link ($r = .16$) between mindsets and efficacy broadly defined (Burnette et al., 2013). In summary, a growth mindset is a belief that development of a skill is possible, it is domain specific, and it is distinct from related theories such as efficacy and from personality traits such as the Big Five.

Growth mindsets predict motivation and self-regulation with downstream implications for goal achievement. For example, individuals with growth mindsets are more likely to persist and redouble efforts when facing challenges, whereas individuals with fixed mindsets are

more likely to disengage and feel helpless (Burnette et al., 2013). Although these findings originally applied to academics, mindsets also predict health and health-related behaviors. For example, growth mindsets of mental health predicted fewer symptoms and greater intentions to engage in therapy (Schroder et al., 2015). And, growth mindsets of drinking tendencies predicted fewer self-reported alcohol abuse symptoms (Schroder et al., 2016). The scholarly foundation linking mindsets to healthier cognitions and behaviors suggests that mindsets are an important belief system that can be used to predict problematic drinking. In the current work, we extend existing research through an investigation of individuals mindsets of alcoholism, going beyond cross-sectional analyses, to examine if growth mindsets of alcoholism predict less problematic drinking over time and if they moderate the drinking identity and problematic drinking link over time. We focused on mindsets of 'alcoholism' because, although the term is dated with respect to the research literature, it is commonly used in lay language and in Alcoholics Anonymous to describe a person who has problems with their drinking.

Conceptualization of Current Work

We have two aims in our consideration of mindsets First, we sought to examine the nature of the relationship between growth mindsets and problematic drinking over time. There is nascent research exploring the link between mindsets of drinking and drinking outcomes, but there is none, to our knowledge, focused on mindsets of problematic drinking. To date, growth mindsets (i.e., beliefs that a person's drinking tendencies can change) are associated with fewer self-reported symptoms of alcohol abuse (Schroder et al., 2016). In addition, findings from research examining the implications of mindsets of problematic substance use for treatment intentions (Burnette et al., 2019) indicated that sending a growth mindset message of 'addiction' (e.g., one can change, especially with effort and the right strategies) to individuals with probable substance use problems, relative to a message that addiction is essentially an unchangeable disease, led to greater efficacy and intentions to engage in counseling and cognitive behavior therapy. The findings from this experimental intervention point to the causal role of mindsets in fostering salubrious intentions. And, these findings suggest that growth mindsets of alcoholism should guide motivation and behavior in a manner that predicts less problematic drinking over time.

However, considering the early nature of the current work and the limited explorations within the context of alcoholism, we also consider the alternative relation. That is, growth mindsets might also provide individuals with justification to continue their heavy drinking, believing that they can stop drinking whenever they choose. That is, growth mindsets of alcoholism might make heavy drinkers believe they are less susceptible to drinking problems and in turn, might be used to justify continued problematic drinking. Moreover, growth mindsets could heighten blame and self-stigma and contribute to not recognizing the significance of the problems, which serves as barriers to seeking treatment and quitting or reducing drinking (Cunningham et al., 1993). In summary, our first aim is to examine the simple relation between mindsets of alcoholism and drinking behavior.

Our second aim is to explore the potential role of mindsets as a moderator of the link between drinking identity and drinking outcomes over time. Past research highlights how

growth mindsets matter most in times of ego threat, which is conceptualized and induced in a variety of ways but refers to a threat to self-image or self-esteem. For example, in a meta-analysis, links between mindsets and goal setting as well as goal striving were significantly stronger in the presence (versus absence) of an ego threat, with growth mindsets buffering against deleterious effects of setbacks, challenges, and pressures (Burnette et al., 2013). For individuals who are prone to heavier drinking, having a sense of self that is closely tied to drinking can make curbing problematic drinking a threat to their sense of self. Thus, growth mindsets may play a protective role for individuals whose identity is closely linked to alcohol. However, recent work has failed to find consistent evidence that growth mindsets buffer against threatening situations (Sisk et al., 2018). Thus, to the extent that growth mindsets mitigate perceived susceptibility to alcohol problems or increase self-blame, they might fail to attenuate, or potentially exacerbate, the link between drinking identity and problematic drinking over time. Overall, the literature points to a buffering, moderating role of growth mindsets, with some work questioning this effect. Because it is theoretically plausible that the opposite occurs, we set up this hypothesis using a competing and exploratory approach.

Current Study

We propose three overarching questions. First, we investigated whether implicit and explicit measures of drinking identity predicted problematic drinking outcomes over time (i.e., greater alcohol consumption, more alcohol-related problems, and greater risk of alcohol use disorder). We expected that stronger drinking identity would be associated with greater levels of problematic drinking. Second, we examined whether growth mindsets of alcoholism predicted drinking outcomes over time. Finally, we evaluated whether growth mindsets moderate the link between drinking identity and problematic drinking. For mindset-related questions, we offered and tested competing hypotheses.

Materials and Methods

Participants

Participants (N=422; 59% women) were heavy-drinking recent graduates, ages 19–25 (M = 21.5, SD = 0.9), from a large public university in the Pacific Northwest. The sample was 62% White/Caucasian, 21% Asian, and 13% multiracial; the remaining 5% of participants reported their ethnicity as Black/African American, American Indian/Alaska Native, Native Hawaiian/other Pacific Islander, or unknown, or they declined to answer.

The research described here is part of a larger, ongoing web-based longitudinal study of heavy drinking college graduates. Data come from the assessment, which occurred near the time participants graduated (which we will henceforth refer to as Time 1) and at 4- and 8-month follow up (Time 2 and Time 3, respectively). Participants were enrolled in the study (and their drinking and intention to graduate were evaluated) five months prior to the Time 1 assessment. Attrition occurred such that retention rates since enrollment were 90.5% at Time 1, 89.8% at Time 2, and 86.7% at Time 3.

Measures

Implicit Drinking Identity.—The drinking identity Implicit Association Test (IAT; Lindgren et al., 2013) was used to evaluate implicit drinking identity. This computer-based reaction time task was adapted from Greenwald et al (1998) and was used to measure the strength of association between the concepts of *drinker* (vs. *non-drinker*) and *me* (vs. *not me*). Words representing the target categories of *me* (i.e., me, my, mine, self) or *not me* (i.e., they, them, their, other) or the attribute categories of *drinker* (i.e., drinker, partier, drunk, drink) or *non-drinker* (i.e., non-drinker, abstainer, sober, abstain) appear individually, center-screen. In the critical blocks of the task, target and attribute categories are paired (e.g., *me* and *drinker* on the left, *not me* and *non-drinker* on the right,) and participants are asked to classify the words into their respective category, by pressing *e* for those categories on the left and *i* for those on the right, as quickly and accurately as possible. Category pairings are then switched (e.g., *me* and *non-drinker* now on the left, *not me and drinker* on the right). Pairings are counterbalanced.

If a word is incorrectly categorized, a red "X" will appear onscreen, and participants must correct their errors before continuing. Response latencies, from stimuli presentation to correct categorization, are recorded. Shorter latencies are expected when target and attribute pairing are more strongly associated with one another. Scores were calculated using the D_1 scoring algorithm (Greenwald et al., 2003), with higher scores representing shorter latencies when *me* and *drinker* were paired (vs. when *me* and *non-drinker* were paired) and interpreted as indicating stronger associations between *me* and *drinker* (vs. *me* and *non-drinker*) or a stronger implicit drinking identity. Data were screened to meet the following criteria recommended by Nosek et al. (2007): less than 10% trials faster than 300 ms and less than 30% trials with errors. Scores for 7 participants were screened out based on these criteria.

Explicit Drinking Identity.—The Alcohol Self-Concept Scale (Corte and Stein, 2007; Lindgren et al., 2013) was used to assess explicit drinking identity. The scale was adapted from Shadel and Mermelstein (1996), and participants rated, on a 7-point scale from *strongly disagree* (−3) to *strongly agree* (+3), the extent to which they agreed with five statements about drinking being a part of their identity (e.g., "Drinking is part of my self-image"). A mean score was calculated, with higher scores indicating stronger drinking identity. Cronbach's alphas were .93 (Time 1), .92 (Time 2), and .94 (Time 3).

Mindsets of Alcoholism.—Mindsets of alcoholism were assessed via a measure that was created for this study. To create this assessment, similar to past work extending mindset research to new domains (e.g., weight: Burnette, 2010), we replaced the attribute being assessed. That is, we used well validated measures of mindsets (Dweck et al., 1995) and replaced the word person with the word alcoholic. And, as recommended in the literature, we focused on the three fixed-worded items. Specifically, we asked participants to indicate their agreement, on a 6-point scale ranging from *Strongly Agree* (1) to *Strongly Disagree* (6), with three statements endorsing a fixed mindset about alcoholism (i.e., "If you are an alcoholic, you can't really do much to change it;" "Being an alcoholic is something about you that you can't change very much;" and "To be honest, it would be almost impossible to

change once you become an alcoholic"). Mean scores were calculated, with higher scores indicating stronger growth mindsets of alcoholism. Cronbach's alpha was .89.

Alcohol Consumption.—The Daily Drinking Questionnaire (DDQ; Collins et al., 1985) was used to measure typical weekly alcohol consumption. Participants were provided US standard drink equivalencies and asked to report the number of drinks they consumed each day of a typical week over the past three months. Daily counts were summed to create a weekly total.

Alcohol-related Problems.—The 23-item Rutgers Alcohol Problem Index (RAPI; White and Labouvie, 1989) was used to evaluate alcohol-related problems. Respondents were asked to indicate the frequency with which they had experienced various negative consequences (e.g., "got into fights, acted bad, or did mean things") resulting from their alcohol use during the past four months. Two additional items regarding driving under the influence (Larimer et al., 2007) were included for this study. Response options ranged from *never* (0) to *more than 10 times* (4). Responses were summed, with higher scores indicating greater alcohol-related problems. Cronbach's alphas were .90 (Time 1), .91 (Time 2), and .91 (Time 3).

Risk of Alcohol Use Disorder.—The Alcohol Use Disorder Identification Test (AUDIT; Babor et al., 2001) was used to assess risk of alcohol use disorder (AUD). This measure includes 10 items about the occurrence and frequency of alcohol consumption and alcohol-related consequences (e.g., being unable to remember what happened the night before because of drinking) and symptoms of alcohol dependence (e.g., needing a drink first thing in the morning) during the past year. Responses are scored from 0 to 4 and summed to yield a total score, with higher scores indicating greater risk of AUD. Cronbach's alphas were .71 (Time 1), .74 (Time 2), and .72 (Time 3).

Procedures

Participants were recruited from a randomly sampled list of 18- to 25-year-old full-time undergraduate seniors obtained from the university's registrar's office. Potential participants were invited to the study via email. Invitation emails included a link and unique PIN to log in to the study's webpage to learn more about the study, complete informed consent procedures, and complete a brief eligibility screening. Eligibility criteria including self-reporting intentions to graduate in the spring and scoring 8 or higher on the AUDIT, a cutoff score commonly considered indicative of hazardous drinking (Babor et al., 2001), when recruited for the study. The current study's data come from the assessments that occurred 5 months later, coinciding with graduation (Time 1), and the two subsequent assessments that occurred at 4-month intervals (Time 2 and Time 3). Data collection for the larger study is ongoing; participants will be followed for two years post-graduation.

All assessments occurred online and had identical procedures. They could be completed on/at participants' choice of computer, time, and location. Measures were presented in a randomized order. Attention check questions (e.g., "To answer this question correctly, you must answer 'strongly agree.'") were interspersed throughout the assessment to verify

participants were attentive and responding accurately (93% of participants answered all accuracy questions correctly at Time 1, 98% at Time 2, and 97% at Time 3). Participants were compensated $25 and entered into a drawing for one of four $25 Amazon electronic gift cards upon completion of each assessment. Researchers verified participants' degree completion status to confirm eligibility at Time 2. All study procedures were web-based and approved by the university's institutional review board.

Results

Descriptive Statistics and Zero-order Correlations

Table 1 displays the descriptive statistics and zero-order correlations between study variables. As expected, problematic drinking appeared to reduce over time, with means for all three self-reported drinking outcomes (e.g., consumption [typical number of drinks per week], alcohol-related problems [RAPI scores], and risk of alcohol use disorder [AUDIT scores]) decreasing in magnitude over time. On average, participants had positive scores on the implicit measure of drinking identity, indicating associations with the self and drinking (vs. non-drinking) and had negative scores on the explicit measure of drinking identity. The score on the latter was less skewed and higher in magnitude compared to studies of college students that included abstainers and lighter drinkers (Lindgren et al., 2016c, 2013). Participants also reported strong growth (relative to fixed) mindsets of alcoholism. The mean mindset score was 5.06 (SD = .92) out of a possible range of 1 to 6, and 92% of participants scored between a 4 and 6.

Consistent with expectations, identity variables were significantly and positively associated with drinking outcomes across time, with the exception of a single correlation between implicit drinking identity and alcohol-related problems at Time 1 that was not statistically significant. Consistent with hypotheses that growth mindsets of alcoholism would be associated with less problematic drinking, participants who had stronger growth (vs. fixed) mindsets reported less alcohol consumption, fewer alcohol-related problems, and lower risk of alcohol use disorder, and this pattern was consistent across assessment time points. Finally, mindsets were not significantly related to implicit drinking identity but were significantly associated with explicit drinking identity, such that having a stronger growth, relative to fixed, mindset of alcoholism was associated with lower explicit drinking identity.

Longitudinal Analysis Plan and Results

Typical number of drinks consumed per week, RAPI scores, and AUDIT scores were evaluated as outcomes. Preliminary examination of distributions revealed that drinks per week and RAPI scores exhibited large negative skew whereas AUDIT scores appeared more normal. Evaluation of normal probability plots of residuals examining each outcome as a function of time supported treatment of AUDIT scores as normal and provided further indication that treatment of drinks per week and RAPI scores as normal was inappropriate. The COUNTFIT program in STATA15.0 was used to compare drinks per week and drinking problems fit to Poisson and Negative Binomial Distributions, with and without zero-inflation (Long and Freese, 2014). For both variables, negative binomial models were strongly preferred over all other count distributions.

Both drinks per week and RAPI scores were evaluated with multi-level negative binomial regression models whereas AUDIT scores were modeled using a mixed linear regression model. In each analysis, predictors included gender (dummy coded 1=female; 0=male), time, mindsets of alcoholism, implicit and explicit measures of drinking identity, all assessed at the first time point; two-way products of mindsets and drinking identity measures; two-way products of time with mindsets and drinking identity measures; and three-way products of time and mindsets with drinking identity measures. Gender was included to control for known gender differences in drinking outcomes. All predictors were grand mean centered. Centering all predictors has the advantage of producing interpretable coefficients for main effects and interactions in the same analysis and producing a meaningful intercept, in this case, the predicted value of the outcome at the average value of all predictors at the middle time point.

Drinks per week.—Results for the multi-level negative binomial model examining drinks per week are presented in Table 2. Parameter estimates of negative binomial models are log-linked. Coefficients, thus, represent associations between predictors and the natural log of the outcome (Cameron and Trivedi, 2013; Hilbe, 2011). When coefficients are exponentiated, they provide incident rate ratios (IRRs), which represent the expected proportion of change in the outcome for each unit change in the predictor. For example, an IRR value of 1.33 would suggest that each unit increase in the predictor is associated with a 33% increase in the outcome, whereas an IRR value of .76 would suggest a 24% decrease for each unit increase in the predictor.

Results indicated that the average (grand mean) number of drinks consumed per week was 11.53. Main effects were evident for gender, time, implicit drinking identity, and explicit drinking identity. Women reported consuming 24% fewer drinks per week then men. Average drinks per week was 21% lower at the subsequent time point. Implicit identity and explicit identity were both uniquely and positively associated with drinks per week. There was one significant two-way interaction between time and explicit drinking identity, which was qualified by a significant three-way interaction with mindsets of alcoholism. Figure 1 presents the predicted values of the three-way interaction. The pattern of the interaction suggests that participants who were higher in explicit drinking identity had greater reductions in drinks per week over time, but this was primarily true for those who also had a stronger growth (vs. fixed) mindset of alcoholism.

RAPI scores.—Results for the multi-level negative binomial model examining RAPI scores are presented in Table 3. Results for main effects of time and explicit drinking identity were similar to results for drinks per week. RAPI scores decreased over time by 19% at each time point, and participants who were higher in explicit drinking identity reported higher RAPI scores (i.e., more alcohol-related problems). No other main effects were significant. The only significant interaction was a two-way interaction between explicit drinking identity and time: the pattern of which indicated that reductions in RAPI scores over time were more evident among participants who had higher (vs. lower) scores on explicit drinking identity.

AUDIT scores.—Results for the linear mixed model examining AUDIT scores are presented in Table 3. Significant main effects were present for time, implicit drinking identity, and explicit drinking identity, with patterns consistent with the other outcomes. AUDIT scores reduced over time. Implicit identity and explicit identity were both uniquely and positively associated with AUDIT scores. Unlike the other two outcomes, there were no significant interactions.

Discussion

The current study evaluated drinking identity, growth mindsets, and their interaction in a sample of heavy drinking college graduates. First, as expected, there were substantial decreases in self-reported alcohol consumption, with the average drinks per week dropping from 15.65 drinks at the first time point to 9.95 drinks 8 months later (a 36% decrease). AUDIT scores also decreased over time. However, mean AUDIT scores 8 months after graduation were 9.23, still above the cutoff score indicating possible hazardous drinking (Babor et al., 2001). Overall, this decline in drinking is consistent with research indicating that many individuals will naturally decrease their drinking after the college years (Grant et al., 2017; Naimi et al., 2003; Schulenberg et al., 2018). Though this group has reduced their use, even 8 months after graduation, participants continues—on average—to report problematic drinking behaviors.

Second, with respect to explicit and implicit measures of drinking identity, both correlated positively with each of the drinking outcomes assessed at each time point. Consistent with the larger literature on implicit and explicit measures (general: Greenwald et al., 2009; alcohol: Reich et al., 2010) and drinking identity (Lindgren et al., 2016b), the correlations between explicit and implicit identity were positive, significant, and small. Additionally, the correlations between explicit measures of drinking identity and drinking outcomes were larger than the correlations between implicit measures of drinking identity and drinking outcomes. These patterns may reflect shared method variance—explicit drinking identity and drinking outcomes are both measured via self-report, whereas implicit drinking identity is measured via reaction time. Further, relations between implicit drinking identity and drinking outcomes appeared larger for measures that assessed consumption (the DDQ and AUDIT) versus those that assessed problems only (the RAPI). This pattern is consistent with other studies (Lindgren et al., 2016c) and may be because the drinking identity IAT assesses associations with the self and drinking (vs. the effects of drinking). Also consistent with the extant literature, measures of drinking identity were significant predictors in the regression models, with the exception of the non-significant relation between implicit drinking identity and alcohol problems at Time 1.

Furthermore, findings were mixed with respect to drinking identity measures predicting changes in drinking over time. There was some evidence that individuals with stronger explicit drinking identity had larger reductions in alcohol consumption and alcohol-related problems over time whereas there was no evidence that explicit drinking identity predicted changes in AUDIT scores over time or that implicit drinking identity predicted changes in drinking outcomes. It may that be drinking identity itself is changing, perhaps due to changes in one’s social network or environment, goals, and/or roles. Though research is

nascent with respect to changes in drinking identity, there is some evidence that increases in implicit measures of drinking identity are positively associated with subsequent increases in drinking risk and vice-versa (Lindgren et al., 2018a) in college students during the early years of college and that changes in explicit measures of non-treatment seeking hazardous drinkers predict reductions in drinking (Montes et al., 2017). It will be important to evaluate in future research whether *reductions* in drinking identity following college are associated with reductions in drinking outcomes.

Third, growth mindsets of problematic drinking correlated with lower levels of problematic drinking. We observed this relation with each of the drinking outcomes and it held, as a zero-order relation, at each time point. This finding is consistent with the emergent literature on mindsets in relations to alcohol misuse (Schroder et al., 2016, 2015) and substance use treatment intentions (Burnette et al., 2019). This independent relation did not, however, hold up amidst the regression models of drinking behaviors over time that included other predictors. We also note that growth mindsets were negatively related to drinking identity. The relation was non-significant for implicit drinking identity ($r = -.09$) but significant for explicit drinking identity ($r = -.26$). This divergent pattern could reflect shared method variance as both explicit drinking identity and growth mindsets were measured via self-report.

Finally, growth mindsets buffered the relation between explicit drinking identity and drinking outcomes. Specifically, among individuals with stronger explicit identity, those who reported stronger (vs. weaker) growth mindsets also reported larger reductions in alcohol consumption over time. Though not significant, the same pattern of findings was observed with risk of hazardous drinking (AUDIT scores). We did not, however, find the buffering effect of growth mindsets for implicit measures. This could be due to the closer match in terms of what mindsets and explicit identity are thought to be (i.e., beliefs) and how they are assessed (i.e., via self-report) relative to implicit identity (i.e., associations assessed indirectly via reaction time). Thus, mindsets and explicit identity have shared method variance and are thought to reflect similar “types” of cognitive factors. Alternatively, it could be that effects are not robust enough to replicate across all types of assessments: we note, again, the smaller magnitude of effects between implicit drinking identity and drinking outcomes.

Implications for Theory

Consistent with prior research on drinking identity (Caudwell and Hagger, 2014; Corte and Stein, 2007; Gray et al., 2011; Lee et al., 2015a; Lindgren et al., 2016c, 2016a), findings from the current study add to the literature that viewing one’s self as a drinker—especially when assessed explicitly—is problematic. It underscores the importance of considering individual differences in the self and self-concept in alcohol research and ensuring the self is included in our theories of problematic drinking. Far too often, the self is left out of theories of drinking, whether those theories are more psycho-social or neuroscience in nature (Lee et al., 2018; Lindgren et al., 2018b, 2016b), and yet decades of research points to the importance and centrality of the self with respect to cognitive processing, self-regulation, goal-setting, and behavior.

The association between growth mindsets and less problematic drinking for heavy drinkers post college graduation contributes to a growing literature revealing the benefits of growth mindsets in health behavior domains (Zedelius et al., 2017). Consistent with the rich mindset literature, these findings suggest that beliefs in the malleability of alcoholism engage psychological and behavioral processes that serve to promote better well-being. Furthermore, that growth mindsets predicted an increasing reduction in drinking over time only for those with stronger drinking identity is consistent with work showing that mindsets matter most in times of ego-threat, contexts replete with potential unfavorable implications for the self. The mindset literature more broadly might benefit from considering explicit identity as a measure of ego-relevance; this moderator could help elucidate effects that might otherwise be hard to detect and help identify those who might benefit the most from growth mindset interventions.

Implications for Intervention and Public Health Messages

The continued robustness of findings that drinking identity is associated with problematic drinking suggests that it may represent a target for intervention. Drinking identity is largely an untapped target among emerging and young adults. Interventions that seek to decrease one's identification with drinking, especially identification with problematic drinking, or strengthen more adaptive and competing identities might be useful and could potentially draw upon work from research with adolescents (Lee et al., 2015b, 2015a). The potential importance of these interventions is underscored by findings about the importance of transitioning from identification as a problem- to non-problem drinking among non-treatment seeking hazardous drinking adults (Montes et al., 2017).

Our findings suggest that we might be able to leverage growth mindset interventions to reduce the pernicious influence of elevated drinking identity in heavy drinking college graduates. For example, if heavy drinkers believe that their alcoholism is fixed, they may see little value or be reluctant to engage in interventions. Importantly, additional research will be needed to replicate findings and to determine whether targeting alcoholism mindsets during treatment might be a useful adjunctive strategy, especially for at-risk populations. However, any intervention work designed to promote growth mindsets of problematic drinking should be mindful to try to decouple beliefs about future changeability and prognosis from the costly self-blame beliefs that often co-occur and accompany beliefs about changeability. There is a small, but growing, intervention literature focused on leveraging the benefits of growth mindsets by differentiating between expectations regarding the potential to make positive changes and responsibility for the problem in the first place (Burnette et al., 2019, 2017). Thus, in addition to focusing on the potential to change problematic drinking in the future, growth mindset interventions should consider adding messaging designed to decrease blame by, for example, highlighting the role of external factors in the etiology of problematic substance use.

Beyond interventions, researchers and practitioners should also carefully consider how various public health messages about alcohol use disorder, such as referring to alcoholism as a disease, might promote fixed mindsets resulting in unintended consequences. Significant

research shows that framing conditions as a disease can promote fixed beliefs and, in turn, result in adverse outcomes (Hoyt et al., 2017).

Strengths, Limitations, and Future Direction

Among the strengths of the study design are the relatively large sample, high retention rates, and the use of established measures of drinking identity and drinking outcomes. Like any study, it also had limitations. In terms of measurement, we relied on self-report measures of problematic drinking, focused on initial assessments of drinking identity and mindsets and used a new assessment of mindsets. Thus, tests of moderation use baseline assessments. More work is needed to evaluate the stability of these constructs over time and to confirm the psychometric properties of the new mindset scale. We note that changing the attribute of the original mindset scale (i.e., to the word “alcoholic”), could change the nature of the scale. In terms of sampling, we targeted a sample of heavy-drinking US college graduates and thus, note a constraint on generality (Simons et al., 2017). Specifically, findings are likely limited to recent college graduates – a very privileged group – and may not generalize to same-age peers who are not college graduates or to lighter drinkers, to individuals at different developmental stages, or to individuals from different countries with different norms or regulations related to drinking. Additionally, the sample reported strong growth mindsets. Although this is characteristic of growth mindset findings across domains and is consistent with the strong growth mindsets of drinking tendencies found in a college sample (Schroder et al., 2016), it will be important to test if findings hold across samples. In building on these limitations, future research could explore if findings replicate with longitudinal assessments and other populations, establish causality, and examine boundary conditions of findings.

Conclusion

We demonstrated that identity and mindsets matter for predicting drinking outcomes both cross-sectionally and longitudinally. Consistent with past work, explicit (self-report) and implicit (indirect) measures of identification with drinking alcohol predicted continued alcohol use among heavy-drinking, recent college graduates. Importantly, we identified a promising moderator of these relations—mindsets of alcoholism. Among participants with explicitly reported stronger drinking identity, those who also reported stronger (vs. weaker) growth mindsets reduced their consumption of alcohol over time. We hope this initial merging of the drinking identity and mindset literatures is the first of many that investigates how best to leverage growth mindsets to help reduce heavy drinking.

Acknowledgments

This research was supported by NIAAA (R01 AA024732, PI: Lindgren). NIAAA had no role in the study design, collection, analysis or interpretation of the data, writing the manuscript, or the decision to submit the paper for publication. The authors have no conflicts of interest to disclose.

Funding information

National Institute on Alcohol Abuse and Alcoholism (NIAAA), Grant Number: R01 AA024732

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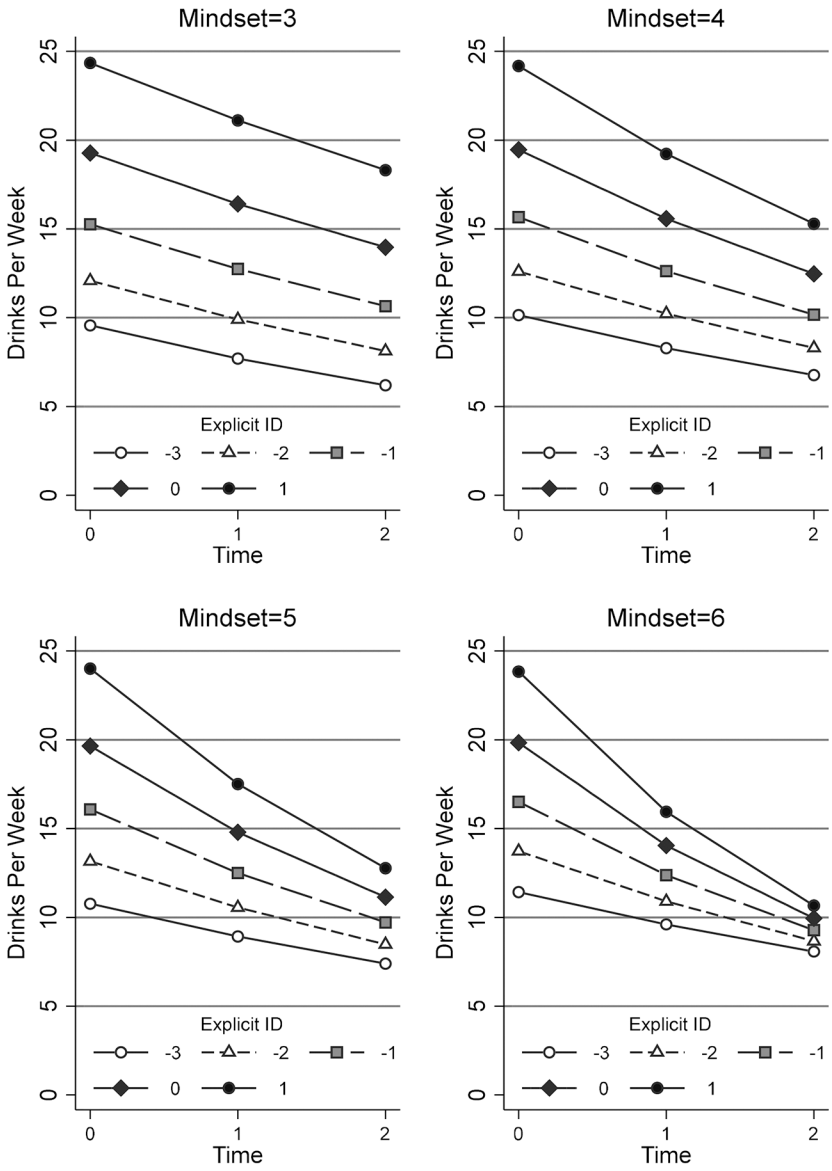

Figure 1.

Drinks per week over time as a function of mindset and explicit drinking identity (Explicit ID). Higher scores indicate stronger drinking identity and stronger growth (relative to fixed) mindsets of alcoholism. Mindsets are plotted at scores from 3 to 6, a range that encompasses the scores of 98% of the sample. Explicit drinking identity is plotted from −3 to 1, a range that encompass the scores of 96% of the sample.

Table 1.

Descriptive Statistics and Zero-order Correlations for Study Variables

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Gender	--												
2. T1 Alcoholism Mindset	.02	--											
3. T1 Implicit Identity	−.10*	−.09	--										
4. T1 Explicit Identity	−.14**	−.26***	.30***	--									
5. T1 Consumption	−.23***	−.12*	.25***	.43***	--								
6. T1 RAPI	−.04	−.22***	.09	.41***	.46***	--							
7. T1 AUDIT	−.04	−.13**	.19***	.43***	.55***	.66***	--						
8. T2 Consumption	−.25***	−.14**	.19***	.35***	.65***	.37***	.48***	--					
9. T2 RAPI	−.02	−.20***	.13*	.40***	.42***	.76***	.57***	.49***	--				
10. T2 AUDIT	−.13*	−.17**	.21***	.43***	.53***	.60***	.73***	.59***	.67***	--			
11. T3 Consumption	−.17**	−.22***	.15**	.31***	.56***	.40***	.44***	.77***	.53***	.54***	--		
12. T3 RAPI	−.05	−.21***	.13*	.31***	.37***	.64***	.51***	.56***	.75***	.59***	.66***	--	
13. T3 AUDIT	−.14**	−.15**	.22***	.43***	.50***	.56***	.70***	.58***	.63***	.79***	.55***	.61***	--
Mean	0.58	5.06	0.26	−1.5	15.62	8.49	11.56	11.92	6.66	10.04	9.95	5.94	9.23
Standard Deviation	0.49	0.92	0.44	1.32	12.34	8.91	5.08	10.02	8.31	5.18	10.55	7.75	4.89

Note. N = 422 (248 identified as female). Gender was coded 0 = male, 1 = female. Alcoholism Mindset = mindsets of alcoholism; higher scores = stronger growth (vs. fixed) mindset. Implicit identity = score on the drinking identity Implicit Association Test; higher scores indicate stronger associations with drinking and identity. Explicit Identity = scores on the Alcohol Self-Concept Scale; higher scores indicate stronger drinking identity. Consumption = self-reported total number of drinks consumed in a typical week. RAPI = scores on the Rutgers Alcohol Problem Index; higher scores = more alcohol-related problems. AUDIT = scores on the Alcohol Use Disorder Identification Test; higher scores = greater risk of an alcohol use disorder.

*** $p < .001$.

** $p < .01$.

* $p < .05$.

Table 2.

Multilevel Negative Binomial Results for Changes in Drinks per Week by Mindset and Drinking Identity

Predictor	*b*	*SE b*	*Z*	*p*	*IRR*	*IRR 95% CI*
Intercept	2.445	0.054	44.86	0.000	11.53	10.36–12.83
Gender	−0.272	0.068	−3.99	0.000	0.76	0.67–0.87
Time	−0.237	0.019	−12.53	0.000	0.79	0.76–0.82
Alcoholism Mindset (AM)	0.012	0.041	0.28	0.778	1.01	0.93–1.10
Implicit Drinking Identity (IDI)	0.286	0.076	3.78	0.000	1.33	1.15–1.54
Explicit Drinking Identity (EDI)	0.166	0.026	6.27	0.000	1.18	1.12–1.24
AM X IDI	0.035	0.088	0.40	0.687	1.04	0.87–1.23
AM X EDI	−0.042	0.027	−1.57	0.117	0.96	0.91–1.01
Time X AM	−0.023	0.022	−1.05	0.292	0.98	0.94–1.02
Time X IDI	−0.021	0.042	−0.50	0.620	0.98	0.90–1.06
Time X EDI	−0.034	0.014	−2.43	0.015	0.97	0.94–0.99
Time X AM X IDI	0.022	0.044	0.52	0.606	1.02	0.94–1.11
Time X AM X EDI	−0.025	0.011	−2.39	0.017	0.98	0.96–1.00
Lnalpha	−2.406	0.171	−14.06	0.000	0.77	0.67–0.88
var(Random Intercept)	0.312	0.031	10.09	0.000	0.78	0.67–0.89

Note. *N* = 422. Coefficients are unstandardized. *IRR* = incident rate ratios. Gender was coded 0 = male; 1 = female). Predictors were grand mean centered. Alcoholism Mindset = mindsets of alcoholism; higher scores = stronger growth (vs. fixed) mindset. Implicit Drinking identity = score on the drinking identity Implicit Association Test; higher scores indicate stronger associations with drinking and identity. Explicit Drinking Identity = scores on the Alcohol Self-Concept Scale; higher scores indicate stronger drinking identity.

Table 3.

Multilevel Negative Binomial Results for Changes in Alcohol Problems by Mindset and Drinking Identity

Predictor	*B*	*SE b*	*Z*	*p*	*IRR*	*IRR 95% CI*
Intercept	1.474	0.081	18.19	0.000	4.37	3.72–5.12
Female	0.108	0.102	1.05	0.293	1.11	0.91–1.36
Time	−0.216	0.027	−8.01	0.000	0.81	0.76–0.85
Alcoholism Mindset (AM)	−0.048	0.063	−0.76	0.445	0.95	0.84–1.08
Implicit Drinking Identity (IDI)	0.122	0.119	1.02	0.305	1.13	0.90–1.43
Explicit Drinking Identity (EDI)	0.278	0.046	6.10	0.000	1.32	1.21–1.44
AM X IDI	0.098	0.127	0.77	0.442	1.10	0.86–1.42
AM X EDI	−0.034	0.037	−0.93	0.354	0.97	0.90–1.04
Time X AM	−0.018	0.031	−0.57	0.571	0.98	0.92–1.04
Time X IDI	0.099	0.064	1.55	0.122	1.10	0.97–1.25
Time X EDI	−0.043	0.019	−2.25	0.024	0.96	0.92–0.99
Time X AM X IDI	0.022	0.057	0.38	0.705	1.02	0.91–1.14
Time X AM X EDI	−0.017	0.015	−1.10	0.269	0.98	0.96–1.01
Lnalpha	−1.684	0.152	−11.06	0.000	0.19	0.14–0.25
var(Random Intercept)	0.690	0.075	9.21	0.000	1.99	1.72–2.31

Note. *N* = 422. Coefficients are unstandardized. *IRR* = incident rate ratios. Gender was coded 0 = male; 1= female). Predictors were grand mean centered. Alcoholism Mindset = mindsets of alcoholism; higher scores = stronger growth (vs. fixed) mindset. Implicit Drinking identity = score on the drinking identity Implicit Association Test; higher scores indicate stronger associations with drinking and identity. Explicit Drinking Identity = scores on the Alcohol Self-Concept Scale; higher scores indicate stronger drinking identity.

Table 4.

Linear Mixed Model Results for Changes in AUDIT Scores by Mindset and Drinking Identity

Predictor	*B*	*SE b*	*Z*	*p*	*b* 95% CI
Intercept	10.412	0.314	33.11	0.000	9.80–11.03
Female	−0.360	0.429	−0.84	0.402	−1.20–0.48
Time	−1.192	0.104	−11.51	0.000	−1.40–−0.99
Alcoholism Mindset (AM)	−0.173	0.204	−0.85	0.397	−0.57–0.23
Implicit Drinking Identity (IDI)	1.023	0.452	2.26	0.024	0.14–1.91
Explicit Drinking Identity (EDI)	1.397	0.180	7.76	0.000	1.04–1.75
AM X IDI	0.061	0.458	0.13	0.895	−0.84–0.96
AM X EDI	−0.376	0.217	−1.73	0.083	−0.80–0.05
Time X AM	−0.067	0.111	−0.60	0.548	−0.28–0.15
Time X IDI	0.172	0.229	0.75	0.452	−0.28–0.62
Time X EDI	−0.051	0.080	−0.64	0.520	−0.21–0.11
Time X AM X IDI	−0.457	0.239	−1.91	0.056	−0.93–0.01
Time X AM X EDI	0.086	0.062	1.39	0.165	−0.04–0.21
var(Random Intercept)	1.293	0.055	23.46	0.000	−0.04–0.21
var(Residual)	0.941	0.038	25.08	0.000	0.87–1.02

Note. *N* = 422. Coefficients are unstandardized. Gender was coded 0 = male; 1 = female). Predictors were grand mean centered. Alcoholism Mindset = mindsets of alcoholism; higher scores = stronger growth (vs. fixed) mindset. Implicit Drinking identity = score on the drinking identity Implicit Association Test; higher scores indicate stronger associations with drinking and identity. Explicit Drinking Identity = scores on the Alcohol Self-Concept Scale; higher scores indicate stronger drinking identity.