A review of implicit and explicit substance self-concept as a predictor of alcohol and tobacco use and misuse

Kristen P. Lindgren,
University of Washington

Clayton Neighbors,
University of Houston

Melissa L. Gasser,
University of Washington

Jason J. Ramirez, and
University of Washington

Dario Cvencek
University of Washington

Abstract

Background—This paper provides an overview of the self-concept as it relates to substance use. Self-concept has a long history in psychological theory and research; however, substance self-concept (e.g., viewing one's self as a drinker or smoker) is an understudied area of research with the potential to expand existing conceptualizations of substance use, addiction, and prevention and treatment efforts, and should receive greater research attention.

Objectives—First, we review and provide a theoretical framework of substance self-concept that draws from dual process models and distinguishes between implicit and explicit self-concept. Next, we summarize key findings related to substance use in the extant literature, focusing on alcohol and tobacco (smoking).

Results—Across both substances, there is converging evidence that substance self-concept is associated with substance use outcomes, including quantity and frequency of use and problems associated with use, and that change in substance self-concept is associated with recovery from substance misuse. Recommendations for the substance self-concept research agenda include routine assessment of substance self-concept, expanded use of implicit measures, investigation of

Correspondence should be addressed to: Kristen P. Lindgren, University of Washington, Department of Psychiatry & Behavioral Sciences, Center for the Study of Health and Risk Behaviors, Box 354944, Seattle, WA 98195, USA. KPL9716@uw.edu.
Kristen P. Lindgren, Department of Psychiatry & Behavioral Sciences, University of Washington; Clayton Neighbors, Department of Psychology, University of Houston; Melissa L. Gasser, Department of Psychiatry & Behavioral Sciences, University of Washington; Jason J. Ramirez, Department of Psychiatry & Behavioral Sciences, University of Washington; and Dario Cvencek, Institute for Learning & Brain Sciences, University of Washington.

moderators of substance self-concept, and targeting substance self-concept directly in prevention and intervention efforts.

Conclusion—Ultimately, we suggest that substance self-concept is a promising, but understudied, construct. Greater research attention to substance self-concept could clarify its potential as an important risk factor for hazardous use and addiction as well as its utility as a prevention and treatment target.

Keywords

self-concept; identity; implicit self-concept; substance use; alcohol; smoking

Cognitive factors have long been studied in substance use (1–3). Explicit (reflective, slow, controlled) *and* implicit (reflexive, fast, automatic) cognitive factors have been investigated, with the majority of published research emphasizing the former and, recently, with increasing attention to the latter. When considering the *content* of cognitions about substance use, scant attention has been paid to cognitions about the self (i.e., self-concept) as relates to substance use. This scarcity is surprising given the long-standing emphasis on the self in psychology (4–6). Moreover, findings from studies that have evaluated substance use self-concept (e.g., viewing one's self as a drinker) have been promising (7–11), suggesting that increased research attention may be fruitful. Thus, we suggest that substance self-concept has been underemphasized in substance use research; that substance self-concepts may be important risk factors for substance misuse; and that targeting substance self-concepts may have clinical utility.

Accordingly, we provide a theoretical framework of the self-concept; extend that framework to substance self-concept; review the available literature; and offer recommendations for future research. We consider both explicit and implicit constructs and measures of substance self-concept and limit our review of findings to alcohol and tobacco because the bulk of the extant literature falls in those domains. Our review is not exhaustive, but rather highlights key theory, methodology, findings, and identifies important gaps and reflects our background in social, personality, and cognitive psychology. Cognitions about the self and substance use have been alternatively referred to as *aspects of the self*, one's *identity*, one's *self-image*, one's *self-schema*, and/or one's *self-concept*. We consider those terms interchangeable and use the term *self-concept* in this paper. We begin with a primer on self-concept.

What is Self-Concept?

The self is a complex system of processes, beliefs, and states, from which different constructs can be posited, including self-concept (12). At the same time, the self is a *social* phenomenon that arises from social experience and changes with it (13). Psychological interest in the self can be traced to the theorizing about the "I" and the "me" by William James (4). According to James, the "I" represents the aspect of the self that actively and subjectively perceives, organizes, and interprets our experience. In contrast, the "me" represents the aspect of the self that becomes the object of our attention or perception when we think about ourselves. It is the "me" aspect of the self that maps most closely onto the self-concept.

With respect to locating self-concept within a larger theoretical formulation of behavior, including substance use, we draw from dual process models (14,15), which focus on the contributions of two types of cognitions to behavior. One type, explicit cognitions, refers to cognitions that are slower, reflective, and introspective, and are posited to have a greater impact on behavior under conditions when an individual can process information deliberately (14). The other, implicit cognitions, refers to cognitions that are faster, reflexive, and impulsive, and are posited to have a greater impact on behavior when self-regulation or cognitive control is impaired or when affect is strong (14). The dual process formulation has been extended to delineate two types of self-concept: implicit self-concept and explicit self-concept (16,17), with the implicit self-concept referring to views about the self that are faster, reflexive, and impulsive, and explicit self-concept referring to views about the self that slower, reflective, and introspective. Consistent with that formulation, we distinguish between the construct (how one theorizes about implicit and explicit self-concept) and its measurement (how one measures implicit and explicit self-concept). We, therefore, discuss the construct and measurement of implicit and explicit self-concept in turn.

The Construct of Implicit Self-Concept

Individual differences in associative representations of the self may be referred to as the implicit self-concept. This definition follows from Greenwald and colleagues' associative model (18), which conceptualizes the self or "me" as a central node in a network of mental associations representing social information (see Figure 1). This network also includes nodes representing positive or negative valence (e.g., *good* or *bad*) as well as nodes representing other, non-valence attributes (e.g. *male* or *female*). Implicit self-concepts are, thus, associations between the self (or "me") node and a non-valence attribute node. An implicit self-concept could consist of an association about the self and a personality trait (*me = shy*; (17), gender (*me = female*; (19) or substance use (*me = drinker*; (20)). An individual would, therefore, have many implicit self-concepts. Further, an implicit self-concept's strength would reflect the potential for one node to activate the other (e.g., how much does activation of *drinker* lead to activation of *me*?) and be bi-directional (18). Consistent with associative (and connectionist) theories of how information is represented mentally (21), activation of a node is presumed to occur by external stimuli (e.g., seeing an advertisement for beer leads to activation of *drinker*) or by internal stimuli, including an already activated node in the network (e.g., activation of *college* leads to activation of *alcohol*) as well as emotions or physiological states (e.g., feeling depressed leads to activation of *alcohol*). Implicit self-concepts that are activated repeatedly are posited to become activated more rapidly, possibly without awareness, and/or conscious control (22). A critical implication of this formulation is that individuals likely have limited insight into and control over implicit self-concept. For example, individuals may be unaware of and/or unable to consciously control their *me = alcohol* association or that association's influence on their behavior. A second implication is that an individual's implicit self-concepts can be differentially activated: some self-concepts will be stronger (or weaker); some will be highly interrelated, some will not; and each self-concept will activated by a unique set of external or internal stimuli.

The Construct of Explicit Self-Concept

The explicit self-concept may be defined as propositional representations of the self (e.g., "I am a drinker," (14,16)). From this framework, representations of the self stem from an individual's experience and rely on reflective processes (e.g., attention, awareness, introspection) and ultimately become condensed into a propositional statement about who the individual is (see Figure 1). This conceptualization is not only consistent with dual process models (14–16) but also with classic theories of personality, such as Bem's Self-perception Theory (23), which holds that individuals learn or "know" who they are from observing their own behavior and the circumstances surrounding their behavior. Across dual process models and Self-perception Theory, self-statements/self-knowledge are theorized to influence an individual's intentions and ultimately, actual behavior.

Like implicit self-concept, explicit self-concept is dynamic and context-dependent. An individual is assumed to have many explicit self-concepts, and due to limits of attention and awareness, a subset would be available at any given moment (24). A critical implication of this formulation is, thus, the reliance on individuals' awareness and introspection. This reliance would suggest that, in contrast to implicit self-concept, explicit self-concept is substantially more "know-able" – that is, all individuals need to do is to introspect. However, some caution is warranted given research demonstrating that individuals' self-knowledge is limited, whether by motivation, opportunity, ability, and/or awareness (25), and that individuals often and unwittingly tell more than they actually know about themselves (26). This formulation also sheds light on how implicit and explicit self-concepts in the same domain (e.g., smoking) could differ within the same person. Depending upon awareness, ability, motivation, or opportunity, an individual might not have a strong explicit self-concept but might have a strong implicit self-concept (or vice-versa).

Measurement of Self-Concept

When considering the measurement of self-concept, we describe the ways that implicit and explicit self-concepts are most commonly measured and their strengths and limitations. The Implicit Association Test or IAT (27) is the most commonly used measure of implicit self-concept. It is a computer-based reaction time measure that requires participants to sort stimuli belonging to four different categories (e.g., *me*, *not-me*, *smoker*, *non-smoker*) using only two response buttons (e.g., computer keys "E" and "I"). In the critical blocks of an IAT, participants use one response button (e.g., "E") to categorize stimuli representing the categories of *me* and *smoker* and another response button (e.g., "I") to categorize stimuli representing the categories *not-me* and *non-smoker*. Then, the pairings are switched such that *me* and *non-smoker* require the "E" response and *not-me* and *smoker* require the "I" response. The difference in reaction times when responding under the two sets of instructions is considered a proxy for the relative strengths of the associations in memory.

IATs are quick to administer, are relatively resistant to faking (28,29), and have relatively high internal consistencies (17). The IAT does not require awareness of what is being measured and does not rely on verbal self-report, making it less subject to self-presentation concerns. Like any measure, it has limitations. It is computer-based, which inherently makes administration more complex than a self-report questionnaire. Test-re-test reliability

correlations for self-related IAT scores – often between .60–.70 – are higher than other implicit measures (e.g., evaluative priming tasks) but lower than self-report questionnaires (17). Further, the IAT is a relative measure – that is, by its nature, it evaluates the strengths of pairs of associations and cannot speak to the strength of a single set of associations. Finally, it is not process pure –while the IAT is described as a measure that evaluates implicit associations and processes, it most likely requires some use of controlled processes, too (30).

Explicit self-concept, in contrast, is typically evaluated by self-report. Such evaluation is straight-forward and technically uncomplicated: one simply asks individuals about how they view themselves. Thus, questionnaires are commonly used. To the degree that individuals' knowledge about explicit self-concept is accessible via introspection, measures of explicit self-concept are useful, simple and inexpensive to administer, and often have high internal and test-re-test reliabilities (17). They also have limitations, including that individuals may not be aware of some explicit self-concept and/or may be motivated to present themselves in a particular light as well as measurement error. Perhaps the best illustration of the respective value of implicit and explicit measures comes from a meta-analytic review of 184 research studies (31). This meta-analysis found that, across nine different domains (e.g., intergroup behavior, political preferences, close relationships), implicit and explicit measures had predictive validity, suggesting that both are useful and not redundant.

Self-Concept and Substance Use

We now turn to extending dual process-models to implicit and explicit substance use self-concept, specifically. Regarding implicit self-concept, we posit that engagement in substance use, exposure to cues or consequences of substance use, and how one's culture regulates and perceives substance use will activate associations related to substance use and motivational orientations (e.g., *alcohol* = *approach* associations) and attitudes (e.g., *alcohol* = *good* associations) and coalesce into self-relevant associations (e.g., *alcohol* = *me*; implicit alcohol self-concept). We also posit that the same substance use behaviors and cues will contribute to one's reflective, introspective experience of who one is, leading to the development of an explicit self-concept (e.g., the propositional statement "I am a drinker;" explicit alcohol self-concept). Finally, we hypothesize that multiple substance self-concepts are possible at the implicit and explicit level: substance self-concept (e.g., alcohol self-concept), substance behavior self-concept (e.g., drinking self-concept), substance using group self-concept (e.g., drinker self-concept), and substance dependence self-concept (e.g., alcoholic/recovering alcoholic self-concept). Whether those self-concepts represent meaningful differences, and how those differences may vary for different stages of substance use is unknown.

A key issue is how substance self-concepts develop and change across stages of substance use (e.g., initiation, escalation, addiction, recovery). It is possible that children and adolescents could develop a substance self-concept before using (e.g., via exposure to family member's use, peer use or media) and greater exposure to those sources could strengthen that self-concept. Initiation and escalation of substance use, in turn, could provide experiences that strengthen/weaken substance self-concept to the degree that experiences are reinforcing/non-reinforcing. Substance self-concepts might also become stronger and more

easily activated than other valued self-concepts, consistent with qualitative research that the loss of positive identities combined with the increase of a user self-concept appears to be one pathway into addiction (32). Conversely, abstaining from substance use may weaken substance self-concepts over time and lead to the development of new, incompatible self-concepts (e.g., non-drinker self-concept) – consistent with theory and findings that that increased (explicit) recovery self-concept is associated with better treatment outcomes (33–35).

Beyond the literature and frameworks common to social/personality and cognitive psychology, cognitive neuroscience approaches to addiction also have important implications for the development of substance self-concept and its influence on substance use. Specifically, recent reviews suggest that individuals who are addicted to alcohol or other substances may have impairments in neural circuits and/or cortical structures (e.g., the insula, anterior cingulate cortex, and posterior cortical midline structures) critical for self-awareness, introspection, interoception, exteroception, and controlled decision-making (36–38). Depending on the specific circuit or region of interest, different impairments or deficits related to self-awareness have been proposed. For example, a model by DeWitt and colleagues (36) suggests that individuals who are addicted to a substance become hypersensitive to substance-related cues over time. Those cues are posited to be increasingly "tagged" as self-relevant, which in turn, can lead to the development of a substance-related identity, which in turn can influence subsequent substance use. Additional work by Moeller and Goldstein (37) adds complexity to the picture; individuals with addictions appear to have impairments in their ability to introspect, their awareness of "who" they are, and their decisions. Taken together, these models might suggest that on the one hand, individuals with severe substance problems would have strong substance-related self-concepts, and that on the other hand, those individuals may be less aware of those self-concepts. This supposition would also imply a limit to a substance self-concept's strength and/or usefulness as a predictor: its increasing strength (assuming that its strength *is* a function of heavy, chronic substance use) would also be accompanied by compromises to neural pathways critical for self-awareness and reflection. Although speculative, it may be that at heavy, chronic levels of use, explicit substance self-concept (the assessment of which relies on awareness) may be less helpful/predictive than implicit substance self-concept (the assessment of which does not rely on awareness). This reasoning would not only be consistent with research and models that focus on self-awareness deficits as a potential mechanism underlying addiction, but also with dual process models of substance use, which suggest that implicit cognitive processes generally become more dominant when substance use is habitual. Translational research that integrates social/personality/cognitive psychology *and* cognitive neuroscience approaches will be critical for understanding the underlying neural substrates of substance self-concept and how substance self-concept does (or does not) fit within current formulations of impaired self-awareness as potential mechanisms of addiction.

Implicit and Explicit Measures of Substance Self-Concept: Findings

We now turn to findings related to implicit and explicit measures of substance self-concept, focusing first on alcohol and then on tobacco.

Alcohol

We conducted a PsycINFO search (with no date limitations) pairing all possible combinations of the terms *alcohol* or *drink** with *self-concept*, *self concept*, *self-schema*, *self schema*, *self association*, or *identity*, and we found 26 published papers. We consider implicit and explicit alcohol self-concept in turn and summarize key findings therein.

First, researchers have assessed explicit alcohol self-concept using brief questionnaires adapted from the smoking literature (9) that ask individuals to rate their agreement with three to five statements concerning the extent to which drinking plays a part in one's life and personality (e.g., Drinking is part of 'who I am'). From a face validity standpoint, these items appear to map well onto the construct of explicit alcohol self-concept as conceptualized as a propositional statement about *who* one is with respect to drinking alcohol. These measures have good internal consistency, have been shown to predict unique variance in alcohol consumption, alcohol-related problems, and cravings with large effects sizes (9,39,40). Explicit alcohol self-concept also predicts attitudes towards drinking (41), binge drinking (42), is associated with greater difficultly in refusing a drink (43), and differentiates heavy drinking college students with severe AUDs from those with less severe AUDs (44). Explicit measures of alcohol self-concept have been added to prominent theoretical models of drinking (e.g., the Theory of Planned Behavior) and have been found to improve them (45). Recent studies have examined moderators of the relationship between explicit alcohol self-concept and drinking outcomes and have demonstrated that explicit alcohol self-concept is a stronger predictor of drinking outcomes among younger individuals (46) as well as in individuals high in individualism (47), high in levels of self-control (48), and low in motivation to reduce their drinking (49). Finally, explicit alcohol self-concept appears to mediate the positive relationship between drinking motives and alcohol consumption (49). To date, research is largely been cross-sectional. However, two studies have found that explicit alcohol self-concept predicts future drinking and problems even after controlling for current drinking (39,40). Additional longitudinal and experimental studies will be important to determine whether there is a causal relationship between alcohol self-concept and drinking outcomes.

A few studies have evaluated alcohol self-concept with respect to misuse and recovery. For example, a cross-sectional study evaluated two explicit alcohol-group self-concepts in a sample of recovering alcoholics (34). One four-item questionnaire asked individuals to rate their agreement with statements concerning the extent to which they identify with Alcoholics Anonymous and a second asked individuals to rate their agreement with statements about identifying as an addict (e.g., "Being an AA member/addict is a central part of who I am"). Having a recovering addict self-concept versus a using addict self-concept was correlated with higher recovery self-efficacy and reduced rates of relapse. Similarly, a prospective study of new residents at a treatment community for substance problems found that increases in seeing oneself as part of that community (treatment community self-concept) predicted greater treatment retention among alcoholics (33).

Implicit alcohol self-concept has been evaluated using two variants of the IAT: the Alcohol Identity IAT (50) and the Drinker Identity (9). These IATs are similar, but not identical, in construction. The Drinker Identity IAT measures associations between words describing *me*

(me, my, mine, and self) versus *not me* (they, them, theirs, other) and words describing *drinker* (drinker, drink, drunk, and partier) versus *non-drinker* (non-drinker, abstain, sober, and abstainer). The drinker/non-drinker categories and stimuli, thus, include a combination of words describing the substance, behavior, and substance group. The Alcohol Identity IAT uses the same words as stimuli for *me* and *not m*e but uses the category label *alcohol* (instead of *drinking*) and images of alcohol and the category label *water* (instead of *non-drinking*) and images of water. Thus, the Alcohol Identity IAT specifically and exclusively evaluates the substance. These IATs have only been evaluated in separate studies, thus it is unknown whether these differences are meaningful.

Both IATs have good psychometrics and predict unique variance in multiple alcohol-related outcomes among college student and adult samples, including self-report and lab-based alcohol consumption, problems, harm, cravings, and behavioral economic indices of alcohol demand (9,20,41,46,50–53). The Drinker Identity IAT also predicted unique variance in drinking after controlling for explicit alcohol self-concept, other well-validated alcohol-related IATs (9,20,39), and other well-validated cognitive factors (e.g., alcohol expectancies, drinking motives, social norms) associated with drinking outcomes (40). The Drinker Identity IAT was also the most consistent and unique predictor of drinking outcomes when multiple alcohol-related IATs were evaluated simultaneously (9,20). Preliminary evidence suggests both alcohol self-concept IATs prospectively predict risky alcohol behaviors and consumption, and that they do so after controlling for current drinking (39,40,50). Studies investigating moderation effects have found that implicit alcohol self-concept is a slightly stronger predictor of hazardous drinking for women, and may have small synergistic effects with explicit alcohol self-concept such that individuals who are low in both are especially unlikely to be drinkers (46).

Most studies with these IATs have had younger and non-clinical samples, raising questions about whether the IATs will generalize to older and/or clinical samples. There is some indirect and direct evidence suggesting they will. First, the IAT psychometric literature (54–56) indicates that an IAT's category labels (e.g., me, not me, drinker, and non-drinker) are more influential an IAT's score than the IAT's stimuli. Essentially, if stimulus items (drunk, partier) can easily be sorted into the higher order category (drinker), the higher order category will be more influential on the IAT score. Underlining this point, IATs have been created in which X's and O's were used as stimuli to represent categories (arts and math), and typical IAT effects (i.e., associating men with math and women with arts) were elicited (54). This suggests that even if a stimulus item (e.g., partier) is less relevant to individuals who are older and/or have more severe alcohol problems, the overall IAT would still be a valid measure of implicit drinker self-concept. Second and more directly, recent studies with large samples (< 10,000 individuals) that include a broad age range (18 to 80+) and the full range of scores on a measure of alcohol use disorder, indicate that the drinking identity IAT is a robust predictor of risk of an alcohol use disorders (46,53). Thus, while additional work with older and clinical samples is needed, preliminary evidence suggests that findings may generalize.

Tobacco (Smoking)

We identified 60 published studies using the same "self" search terms combined with *smok**, *tobacco*, or *nicotine*. Most studies assessed explicit smoking self-concept to predict current smoking behaviors or future intentions to smoke. Commonly, a categorical approach was used: participants were asked if they identify as a smoker or a type of smoker such as "social smoker" (57–59). While high in face validity, many individuals who reported smoking within the previous 30 days did not identify themselves as smokers of any type (60). These individuals ("deniers"; (57,59)) tend to smoke less frequently and report no failed quit attempts or addiction (59). The next most common approach to evaluating explicit smoking self-concept is to use brief questionnaires (57,61,62). For example, the smoking self-concept scale asks individuals to indicate their agreement with five statements describing how much smoking plays a part in one's life and personality (e.g., Smoking is part of my personality; (63)). This measure has good internal consistency, and stronger explicit smoking self-concept appears to predict smoking escalation (8). The predictive utility of explicit measures has been demonstrated across a range of populations, differentiating daily smokers from intermittent and experimental smokers among college students (62), predicting greater usage of electronic cigarettes (64), and predicting the degree of tobacco dependence among patients in treatment settings (61). Further, explicit measures have examined the development of smoking self-concepts, which appear to be associated with increases in negative affect coping motives for smoking over time (65).

Smoking self-concept has been evaluated in relation to quitting and relapse. For example, quit attempts were negatively correlated with smoking self-concept and positively correlated with quitting smoking self-concept (e.g., "[Quitting] smoking within the next three months fits with the kind of person I want to be"; (66)). Smoking self-concept is also negatively correlated with prospective confidence in quitting at 1 and 6 months following assessment (61). For many smokers, smoking self-concept persists after quitting, but decreases over time, with less than a fifth reporting a residual smoker self-concept after two or more years of abstinence (11). To this end, self-reported identification as a non-smoker is positively correlated with intentions to quit (67), and continued abstinence among ex-smokers (68). The development of a recovery self-concept may also be protective for smokers attempting to quit. Greater preference for an "ex-smoker" as opposed to a "smoker" self-concept predicted lower relapse rates over a two-year period among ex-smokers who had been smoke-free at the time of self-concept assessment (34). Thus, explicit smoking self-concept predicts important smoking-related behaviors for current and former smokers.

Implicit smoking self-concept research is scant. Two published studies have evaluated implicit smoking self-concept using the IAT. Swanson and colleagues (69) developed an IAT evaluating *self* words (me, mine, self) and *other* words (they, them, other) and *smoking* words (smoke, cigarette, smokers) and *stealing* words (steal, robbery, thief). The *stealing* category was selected as a contrast to smoking because it is a negative behavior: most smokers and non-smokers view smoking as negative (on both implicit and explicit measures), and the researchers wanted to match smoking with another negatively-valenced category. An alternative version was also developed by the same research team; it used pictures of household scenes but varied whether or not smoking cues were present (69). Both

IATs were positively correlated with self-reported smoking behavior and self-reported preference for smoking. Further, there were significant differences in smoking self-concept IAT scores among smokers and non-smokers, with smokers having stronger *self = smoking* associations than non-smokers. A second study investigated whether context (i.e., movie clips with smoking or non-smoking actors) affected implicit smoking self-concept (70). Stronger implicit smoking self-concept was found among those participants who identified with the smoking actor, regardless of whether they actually smoked (70). That finding suggests that watching another person smoking could activate one's implicit smoking self-concept and that the IAT may be sensitive to that activation.

Summary and Integration

Several important themes emerge from the alcohol and tobacco self-concept literatures. There is substantial cross-sectional evidence that both explicit and implicit substance self-concepts are positively associated with substance use behaviors. There is preliminary evidence that substance self-concept predicts prospective substance use, and that changes in substance self-concept are associated with treatment outcomes. Third, there is substantial evidence that implicit and explicit alcohol self-concept predicts unique variance in drinking behaviors. We would expect similar findings in the tobacco domain, but this question has yet to be investigated. Fourth, implicit alcohol self-concept is a more robust predictor of outcomes relative to other, well-validated implicit alcohol-related associations; we would predict similar (but know of no published) findings for smoking. Finally, moderation studies —largely in the alcohol literature and largely focusing on explicit self-concept—are beginning to identify subsets of individuals for whom substance self-concept is a particularly robust predictor of substance use outcomes, with low motivation to change, self-control, and individualism emerging as significant moderators.

Recommendations

We now turn to recommendations for future research.

1. Assess Substance Self-Concept in Substance Use Research

An overarching recommendation is for substance self-concept to be routinely assessed in substance use research and evaluated as a candidate mechanism for substance use initiation, escalation, maintenance, and relapse. The extant literature demonstrates the promise of substance self-concepts as predictors of important substance use behaviors substances across the stages of use and misuse. However, it is critical to *deepen* our understanding of alcohol and tobacco self-concept via research with clinical and child/adolescent samples and to *broaden* our understanding of substance self-concept by extending its assessment to other substances (e.g., marijuana, opioids, stimulants). Additionally, there are critical, unanswered questions with respect to the exact role substance self-concept plays in use and misuse, which are important to address. For example, during early stages, substance self-concept may function largely as a *marker* of an individual's use and level of risk whereas during later stages, its role may expand to become an additional *driver* of use.

2. Expand the Use of Implicit Measures of Substance Self-Concept

We particularly recommend expanded use of implicit measures of substance self-concept. Theory suggests and findings demonstrate that they account for unique variance in substance use outcomes. Further, implicit measures are less subject to self-presentation and social desirability concerns, and expanding their use may be particularly helpful because of the stigma surrounding substance use, misuse, and treatment. Additionally, findings and models from cognitive neurosciences regarding impairments in neural circuits and regions related to self-awareness and introspection among individuals with addictions suggest that implicit measures could be particularly valuable among heavier users and clinical samples.

3. Identify Moderators of Substance Self-concept

We recommend investigating potential moderators of substance self-concept. For example, individual will encounter situational or emotional cues (e.g., stress, other people, and particular street corners) that are likely increase or decrease the activation of substance self-concepts and ultimately, substance use. Gaining an understanding of this interplay would provide important information on the boundary conditions of substance self-concept as a predictor. In addition, translational research that investigates how changes or impairments in neural circuits or regions critical for self-relevant processes might moderate the influence of substance self-concept would be useful for advancing theory and intervention.

4. Consider Substance Self-Concept as Potential Prevention and Treatment Targets

Substance self-concept should be investigated as a specific target for prevention and intervention efforts. One possible strategy would be to help individuals develop more adaptive identities. This might include the development of a recovery identity, which has been found to be associated with improved treatment outcomes (33–35); the development of a lower risk identity (e.g., a moderate drinker); and/or the development of another, valued aspects of an individual's identity (e.g., family identity, professional identity). Motivational interviewing (MI) (71) may be ideally suited to changing individual substance self-concept because it includes an exploration of substance use's fit with an individual's overall values and goals. Further, positive treatment outcomes in MI have been linked to changes in self-referential processes (72), and it is possible that could extend to self-concept. Cognitive bias modification (CBM) techniques, which typically adapt an implicit measure (e.g., an IAT) such that participants over-practice the adaptive bias (for example, pairing *me* and *non-drinker* stimuli), might also offer a means to target substance self-concept. A recent study made an attempt (73), but both experiments in the study yielded null results, suggesting that much remains to be learned with respect to feasibility of this approach. Finally, mindfulness techniques, which are thought to target self-relevant processes more broadly (36), might also offer a means to reduce the activation, and ultimately, strength of substance self-concept.

Conclusion

Substance self-concept is underemphasized in research, which is surprising given psychology's long tradition of studying the self. Although substance domains vary with respect to the amount and type of attention paid to self-concept, there is converging evidence that it is a unique predictor of drinking and smoking outcomes at different stages of the

lifespan and addiction. We propose that substance use research will be enhanced by increased attention to substance self-concept by using both implicit and explicit measures, investigating how substance self-concept develops, and evaluating it as a potential prevention and intervention target.

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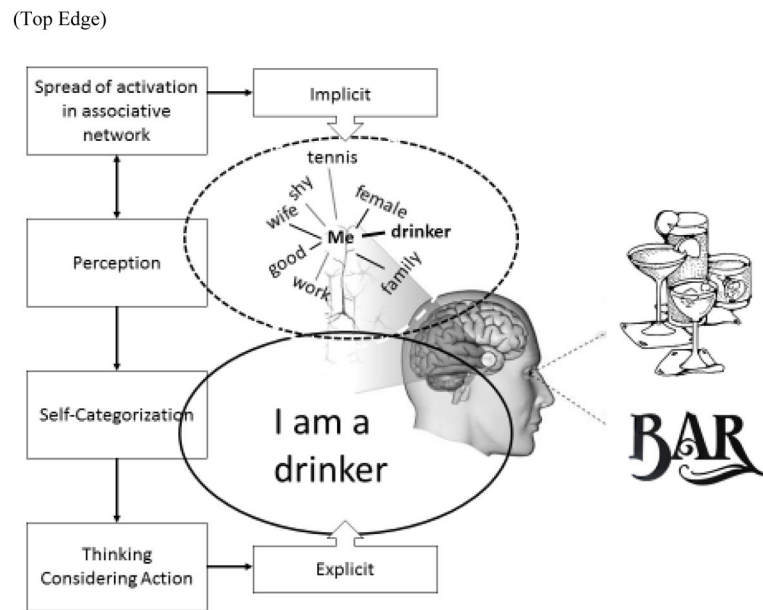
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Figure 1.
Illustration of implicit and explicit self-concept, adapted from dual process models. Individuals would have multiple self-concepts that can be activated via internal and external stimuli, with implicit self-concepts thought to reflect faster, more impulsive processes and explicit self-concepts thought to reflect slower, more deliberate processes. An implicit self-concept is defined an associative representation of the self (e.g., me = shy, me = female, me = drinker). An explicit self-concept is defined as a propositional statement about who one is (e.g., I am shy, I am female, I am a drinker).