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MEASURE DEVELOPMENT OF AN ASSESSMENT OF 'HITTING BOTTOM' FOR INDIVIDUALS WITH ALCOHOL PROBLEMS

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THESIS

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ABSTRACT

Alcohol problems are a serious public health concern but few individuals with alcohol problems and alcohol use disorders (AUDs) ever receive formal treatment (SAMHSA, 2009). To understand and address this phenomenon, it is important to understand why individuals decide to seek treatment, which may help clinicians facilitate treatment entry and completion among individuals with AUDs. Research on reasons individuals cite for seeking treatment and their success in recovering from AUDs suggests that "hitting bottom" may be important (e.g., Sobell, Sobell, Toneatto, & Leo, 1993). Accordingly, evaluating the concept of "hitting bottom" may provide insight into why individuals seek and complete treatment; however, "hitting bottom" has never been operationally defined. Consequently, the goal of this multi-phase study was to address this gap in the field by developing a measure of "hitting bottom." Literature review and both qualitative and quantitative data analyses informed the development of a preliminary

measure of "hitting bottom." Feedback about the measure was obtained from experts in the field (*N* = 9; 11% Female). The final, 114 item measure, called the Noteworthy Aspects of Drinking Important to Recovery (NADIR) measure, was administered via web-based survey to individuals self-identified as moderate to heavy drinkers across the United States (*N* = 402; 46.6% Female, 24.6% Hispanic, average Alcohol Use Disorders Identification Test (AUDIT) 16.3 (SD = 8.3)). Exploratory factor analyses, item response theory, and confirmatory factor analyses were performed to analyze the factor structure of the NADIR. The final confirmatory factor model of the NADIR measure included 60 of the original 114 items, provided an adequate fit to the data, and consisted of four domain specific factors (social network, health problems, situational and environmental circumstances, and existential issues domains) and two higher order factors (cognitive appraisal and importance/influence). The factors of the NADIR measure showed concurrent validity with measures of drinking quantity and frequency, as well as drinking consequences and the AUDIT. Future research should empirically evaluate the predictive validity of the NADIR and identify if and for whom "hitting bottom," as measured by the NADIR, may be important for facilitating treatment entry or self-change.

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Introduction

Background

Alcohol use disorders (AUDs) result in serious consequences for the individual as well as for others in society. In a 2004 report by the World Health Organization (WHO), societal and economic costs associated with alcohol abuse (as defined by DSM-IV-TR criteria for Alcohol Abuse; American Psychological Association, 2000) in the United States alone were estimated to be $184.6 billion. Yet, this high monetary cost to society does not account for the myriad of consequences experienced directly by individuals with AUDs. Some of the consequences associated with AUDs include unemployment, interpersonal conflict, increased risk of accidental and self-inflicted injury, and increased risk of coronary heart disease and other medical problems (US Department of Health and Human Services, 2000; WHO, 2004). Moreover, there are an estimated 76.3 million people worldwide meeting criteria for an AUD (WHO, 2004), but most of these individuals either do not receive formal treatment or drop out of treatment prematurely (Callaghan, Hathaway, Cunningham, Vettese, Wyatt, & Taylor, 2005; Cohen, Feinn, Arias, & Kranzler, 2007; SAMHSA 2009). Additionally, the Substance Abuse and Mental Health Services Administration (SAMHSA; 2009) noted that approximately one third of individuals who felt they needed treatment for alcohol problems did not receive treatment. Of these individuals who explicitly felt they needed treatment, the majority chose not to receive treatment for a variety of reasons (e.g., because they did not feel ready to stop drinking; SAMHSA, 2009). In order to address disparities in treatment utilization, it is important to understand why people with AUDs seek treatment or not. Further, there is a clear need to develop effective screening and intervention strategies to

facilitate treatment entry for such individuals or self-change among individuals who do not feel treatment is appropriate for them.

To develop screening and intervention strategies for individuals needing but not seeking treatment for alcohol problems, it is important to understand the factors that lead individuals to seek treatment on their own. Cunningham and colleagues (2005) found that current heavy drinkers with more severe alcohol problems and greater perceived risk of drinking were more likely to consider changing their alcohol use than individuals with fewer alcohol problems and less perceived risk. Similarly, among individuals who have become interested in seeking treatment, external life events (e.g., loss of job) as well as internal events (e.g., "drug problem became chronic," p. 691) have been listed as the primary motivators for seeking treatment (Cunningham et al., 1994). More specifically, Cunningham and colleagues (1994) found 10 primary reasons for seeking alcohol treatment through a content analysis of interviews with individuals who had successfully resolved an alcohol problem (see Sobell, Sobell, Toneatto, & Leo, 1993 for description of original study). These 10 reasons were listed as a "pros and cons evaluation" (p. 693) similar to a decisional balance, having received a warning about one's alcohol use from a spouse or significant other, having "hit rock bottom" (p. 693), having experienced a traumatic life event, undergoing a major lifestyle change, seeing someone drunk or high, having been warned about continued alcohol use by one's physician, knowing someone who successfully quit or reduced their alcohol use, experiencing health problems, and having a religious experience. In addition to these factors having been important in seeking treatment, endorsement of "hitting rock bottom" as an important factor in seeking

treatment was also associated with greater treatment compliance (p. 693, Cunningham, Sobell, Sobell, & Gaskin, 1994).

"Hitting Bottom"

In the alcohol research field, "hitting bottom" is a phrase that has been used to describe a tipping point at which an individual decides to change his or her drinking behavior. This tipping point is often conceptualized as a culmination of alcohol-related problems; however, not every individual's "bottom" may be comprised of the same problems as another's. For example, one individual may perceive his or her drinking as hitting bottom after losing his or her job, spouse, and home, whereas another individual's hitting bottom may consist of experiencing serious physical problems caused or exacerbated by alcohol use (e.g., liver cirrhosis) that lead the individual to feel a need to change his or her drinking behavior. Accordingly, "hitting bottom" is a term used to describe a multidimensional, individualized construct that can range from a "high" to a "low bottom" and may be comprised of various components.

Moreover, the construct of hitting bottom aligns with prominent theoretical models of addiction. One of the most cited theoretical models relevant to addiction is the transtheoretical model (TTM; Prochaska, DiClemente, & Norcross, 1992). This model focuses on stages of change in which different levels of motivation (i.e., the different "stages," ranging from Precontemplation to Maintenance) are connected to the different phases of addiction and recovery (e.g., contemplating treatment and maintaining abstinence). Hitting bottom fits into the TTM in that experiencing negative consequences related to substance use and problem severity have been found to be associated with

transitioning from one stage of change (e.g., Precontemplation) into another, more motivated stage of change (e.g., Action; Życińska, 2006).

Furthermore, the idea of stages of change and the role of motivation in recovery are consistent with some of the theoretical concepts of other prominent models of addiction, including the disease model, which has been adopted predominantly by 12-Step treatment programs and much of the general public (Cunningham, Blomqvist, & Cordingley, 2007). Accordingly, the theoretical concept of hitting bottom has been widely endorsed as a natural part of the recovery process by individuals who subscribe to the disease model of addiction (e.g., Alcoholics Anonymous, 2001; Jellinek, 1960). For example, the "Big Book" from Alcoholics Anonymous states that most individuals "have to be pretty badly mangled before they really commence to solve their [alcohol] problems" (p. 43; Alcoholics Anonymous, 2001).

Because there is theoretical agreement about and some evidence to support the importance of hitting bottom as a step in recovery, formally identifying components of hitting bottom may help individuals who previously chose not to seek treatment to do so, may help tailor treatments to an individual's experiences of hitting bottom, and may also yield important information about an individual's likelihood of success in treatment. However, the construct of hitting bottom has yet to be defined operationally and has been studied primarily in qualitative surveys or by asking individuals whether they endorse having hit bottom or not. This is particularly problematic as hitting bottom may be perceived as an individualized concept, and individuals may not view his or her "bottom" as warranting treatment. Moreover, hitting bottom is often either endorsed retrospectively by clients who have already recovered from an AUD or by clients who are already

seeking treatment; the concept of hitting bottom among individuals with alcohol problems in the general public (i.e., those not in treatment) has yet to be examined. Having a quantitative measure of hitting bottom is important to address these gaps in the literature; therefore, the aim of the present study was to operationalize the construct of hitting bottom by developing a self-report measure.

Measure Development Processes

In order to develop a measure of hitting bottom for individuals with alcohol problems, it was important to review the relevant literature on the topic to provide a theoretical basis for the items in the measure (DeVellis, 2012). Given the nature of hitting bottom as a complex, multidimensional, and individualized construct, a traditional review of the empirical literature on hitting bottom was considered inadequate. Accordingly, a more comprehensive process was undertaken to provide a foundation on which to develop the measure. Specifically, two studies were conducted to develop a measure of hitting bottom. In Study 1 Phase 1, informal thematic analyses of QuitandRecovery.org addiction recovery stories and a literature review yielded insight on potential components of hitting bottom (Study 1, Phase 1). In Study 1 Phase 2, college students were asked what processes they felt were important to recovering from alcohol problems and to hitting bottom. Results from Study 1 (Phases 1 and 2) informed Study 2, which consisted of preliminary measure development and receiving expert feedback (Study 2, Phase 1) and the administration of the measure of hitting bottom to individuals who reported moderate to heavy drinking (Study 2, Phase 2).

Study 1: Measure Development Methods

Phase 1: Review of Potential Components of Hitting Bottom

A preliminary review of the literature and an informal content analysis of the recovery success stories from QuitAndRecovery.org yielded hypotheses for some of the components comprising hitting bottom. QuitAndRecovery.org is a website "dedicated to learning from success in addiction recovery" that allows individuals to share their personal recovery stories with others. Such stories were analyzed informally for thematic content, such as "family problems," to identify the various themes that arose in recovery stories and their relative frequency.

Next, a more exhaustive review of the literature covering the addiction recovery process more broadly provided additional insight. For this literature review, terms listed in Table 1 were subjected to a systematic literature search using PsycInfo, Web of Science, Google, Google Scholar, and PubMed. Results from these searches were included if they were written in English, peer-reviewed, and involved human subjects research. Although the main target for this search was hitting bottom, other related topics were included such that alcohol, other substance use, and behavior change more broadly were included. With such a broad scope to this literature review, searches that yielded several thousand results (e.g., Google searches) were sorted by relevancy (via search engine functions) and reviewed through at least the first 50 results rather than the entirety of results.

Phase 2: Content Analysis of Hitting Bottom Processes

Participants and procedures. Open-ended qualitative data were collected in the context of a larger web-based survey among college students. Participants were

undergraduate college students (N = 75) recruited from psychology classes at a university in the southwestern United States and were at least 18 years old. Participants completed a larger, online survey (see Brown, Bravo, Roos, & Pearson, in press for a full description) and received course credit as compensation for their participation. Although this is a convenience sample, Study 1, Phase 2 was conducted to include a third-party perspective that may be representative of how the general public views recovery and hitting bottom. Accordingly, these responses provide information above what the literature and success stories yielded and may represent perceptions based upon stereotypes, personal and family experiences, and class discussions relevant to AUD recovery.

As reported in Table 2, participants were an average age of 20.3 (SD = 5.1), 72.0% were female, 57.3% Caucasian, 12.0% American Indian or Alaska Native, 12.0% Asian, 2.7% Black or African American, 1.3% Native Hawaiian or Pacific Islander, 12.0% self-identified as "other" race (with multiple responses allowed for race), and 49.3% identified as Hispanic. Two open-ended items assessed participants' thoughts on the essential components for triggering help-seeking and the essential components of hitting bottom for individuals with alcohol problems: (a) "what things are the biggest reasons people decide to get help with or change their alcohol use?" (with responses to this item thought to reflect general recovery processes); and (b) "what things do you think it takes for someone to 'hit bottom'?" (with responses to this item thought to reflect the process of hitting bottom). All procedures were approved by the Institutional Review Board of the participating university.

Qualitative data analyses. Data from the undergraduate college students were analyzed using a hybrid content analysis approach that combines top-down and

grounded-theory approaches (Ryan & Bernard, 2003). In a top-down approach, thematic codes are researcher-generated and were developed based on preliminary hypotheses generated from Study 1, Phase 1. In grounded-theory or "conventional" content analysis, thematic codes are developed from participants' responses using as much of the participants' original language as possible (Hsieh & Shannon, 2005). Accordingly, thematic codes were generated using both literature-derived hypotheses and participant responses. Subsequently, participant responses were coded by two raters, one graduate-level research assistant and one post-baccalaureate research assistant. Interrater reliability (IRR) was assessed via Kappa using SPSS 21 (Cohen, 1960) and was $\kappa = 0.92$ for general recovery and $\kappa = 0.88$ for hitting bottom responses, indicating 92.3% and 88.4% agreement among raters, respectively. See Tables 3 and 4 for a description of the codes used. Tables 3 and 4 present the frequency with which the various codes were used to code participant responses. Although the most frequently coded responses for each question were < 15% of total codes used, this seeming lack of agreement between college student participants may be accounted for by the fact that multiple codes were used for appropriate responses. Accordingly, there were a large number of codes generated and restricting the total number of codes may have yielded more agreement between responses. However, the purpose of the current study was to capture a comprehensive list of potential components of hitting bottom, so multiple codes were permitted.

Study 1 Results

Potential Processes and Components of Hitting Bottom

Results from Phases 1 and 2 of Study 1 highlighted several life domains of potential importance to recovering from AUDs and hitting bottom: social network factors, physical health problems, psychological and emotional problems, situational and environmental factors, existential problems, cognitive appraisal, and self-efficacy and motivation to change.

Social network. Across all stages of the informal analysis of QuitAndRecovery.org, the literature review, and the content analysis of results from 75 college students, social network themes arose in a variety of manifestations.

Family problems. Many of the QuitAndRecovery.org success stories mentioned "failed marriage" or conflicts with one's spouse as an important event preceding recovery from a substance use disorder. Cunningham and colleagues (1994) found that a warning from a spouse or partner was one of the top ten reasons given for successful recovery. More broadly, a number of studies have highlighted the important role family problems play in the recovery process for individuals with substance use problems (e.g., Billings, & Moos, 1983; Miller, Hedrick, & Taylor, 1983; O'Toole, Pollini, Ford, & Bigelow, 2008; Tucker, Vuchinich, & Pukish, 1995). When asked about the behavior change process among individuals with alcohol problems, college students most frequently identified family factors (i.e., data coded as "family") as an antecedent to change. When asked about the processes involved in hitting bottom, the college student participants cited family factors as the second most frequently coded theme comprising hitting bottom.

Social pressure and support. In addition to family problems' association with the behavior change process among individuals with alcohol problems, pressure (conceptualized as coercion or ultimatums to seek treatment, for example) and support (conceptualized as encouragement, for example) from one's social network encouraging an individual to go to treatment has also been highlighted in the literature. Blagojević-Damašek and colleagues (Blagojević-Damašek, Frenci, Perekovic, Cavajda, & Kovacek, 2012) found that social support to seek treatment for alcohol problems was associated with better outcomes. Walters (2000) found similar results for individuals with a variety of substance use problems ranging from tobacco to other drugs of abuse. Social pressure and support to seek treatment were even found to influence a wide array of other problematic health behaviors (Kelly, Zyzanski, & Alemagno, 1991). Although social support and social pressure were not themes identified in QuitandRecovery.org recovery stories or Study 1, Phase 2 results, other social factors (e.g., substance use affecting others) did appear in both qualitative results. Consequently, social pressure and support, couched in a broader social network factors conceptualization, appear to influence recovery from alcohol problems.

Physical health problems. Similar to family problems, physical health problems were a common factor in the QuitAndRecovery.org success stories and arose in Sobell et al.'s findings (1993). Specifically, a physician's warning about continued alcohol use and experiencing health problems were both listed in the top ten reasons viewed as essential to recovery from an AUD (Cunningham et al., 1994; Sobell et al., 1993). In other qualitative research, "physical degradation" was one of the common themes identified in problem drinkers' recovery stories (Smith, 1998). Further, several other empirical

research studies have demonstrated the importance of physical problems in the recovery process (e.g., Finfgeld, 2000; Isenhart, 1994; Kaskutas, 1996; Ludwig, 1985; Stewart & Connors, 2007). The strong empirical support for physical health problems indicates their importance in the behavior change process for individuals with alcohol problems. Physical health and general health concerns also comprised a considerable proportion of the coded responses of college students reporting on their perception of the recovery process.

Psychological and emotional problems. Another recurring topic in the QuitAndRecovery.org success stories was the experience of psychological problems including suicidal ideation, emotion dysregulation, and feeling as if one were "going crazy" due to alcohol use. Moreover, emotional problems, hopelessness, mental health problems, and suicidal ideation were found in at least one participant's response from Study 1, Phase 2. In other research, psychological and emotional problems have been identified as important components in the behavior change process (e.g., Finfgeld, 2000; Prugh, 1986). These findings are consistent with themes identified in Study 1, Phase 2. When college students were asked specifically about hitting bottom, "depression" was the third most frequently coded response.

Situational and environmental factors. Several empirical studies have identified situational and environmental factors as important in the development, maintenance, and resolution from problematic substance use (e.g., Brennan, Moos, & Mertens, 1994; King & Tucker, 1998; Tucker, Vuchinich, & Rippens, 2002; Waldorf, 1983). For example, SAMHSA (1999) noted that personal factors such as motivation to seek treatment are influenced by environmental context. Accordingly, it is important to examine a variety of

situational and environmental factors in the evaluation of the recovery process, specifically in the context of hitting bottom.

Employment, financial, and housing problems. Employment problems were identified in multiple phases of the literature review process as influential in the alcohol use behavior change process. McIntosh and McKageney (2001) found that triggers for hitting bottom included events such as the actual or potential loss of a job, and other research has highlighted the importance of housing problems in addiction recovery (Blume, 1977; Rubington, 1969). These findings are consistent with themes identified in Study 1, Phase 2 that suggest college students perceive employment and financial problems, as well as housing problems, as important components of hitting bottom for individuals with alcohol problems. Furthermore, employment, housing, and finances all arose as themes in recovery stories from QuitandRecovery.org.

Legal problems. Sometimes related to problems with financial stability and housing, as well as with alcohol use itself (e.g., driving while intoxicated), legal problems can be associated with alcohol problems. Several research studies have found that involvement with the legal system impacts treatment-seeking and treatment outcomes for individuals with alcohol problems. For example, Tuchfeld (1981) found alcohol-related legal problems were among the primary attributions given as reasons for change among individuals who spontaneously remitted from alcohol problems. Additionally, Gregoire and Burke (2004) concluded that individuals who entered substance use treatment due to legal coercion were more prepared to benefit from the treatment experience than individuals not legally coerced. However, legal problems were not identified as a theme in the recovery or hitting bottom process by college students; so legal problems may not

be frequently experienced consequences that facilitate behavior change considering the legality of alcohol in the US. Accordingly, involvement with the legal system may be an important factor in the alcohol use behavior change process, but may not be a factor for all who change.

Existential problems. Another theme that emerged from multiple phases of the literature review was that existential problems are important in the recovery process. For example, McIntosh and McKeganey (2001) noted that "existential crises" were common to many participants' accounts of recovery from drug use. Blomqvist (2002) found similar results among individuals who recovered from alcohol or other drug use problems. Existential problems also arose as themes in the recovery stories from QuitandRecovery.org (e.g., "I felt lost in my own skin"). Although college students did not report existential problems per se as important processes in general recovery or hitting bottom, one commonly identified theme (i.e. a code) was suicidal ideation (e.g., "life not worth living anymore"), which may reflect a larger existential crisis. Accordingly, existential issues including conflict within one's perception of his or her identity or values and a process of spiritual change arose as important topics of consideration.

Identity and values conflict. Similar to problems with one's existence, conflict with one's sense of identity or values may play an integral role in the behavior change process. For example, Kearney and O'Sullivan (2003) investigated prominent "turning points" preceding health behavior change and found value conflict and shifts in one's identity were commonly reported as antecedents to behavior change. When examining the behavior change process specifically among individuals with substance use problems,

Klingemann (1991) found that development of a new identity or meaning in life comprised one of three important stages of change. Similarly, "identity crises" were one of the primary reasons for change in alcohol use in retrospective accounts of spontaneous recovery (Tuchfeld, 1981). Further, "identity transformation" has been perceived as pivotal in the maintenance of such behavior change (Walters, 2000).

Spiritual change. Consistent with findings on identity and values conflict as important in the process of behavior change, spiritual change has been similarly highlighted as a valuable component in behavior change. Although much of the research to date in this area has focused on spiritual changes among individuals who have recovered from substance use problems (predominantly among members of Alcoholics Anonymous), some evidence suggests that spiritual changes may be involved in other areas of behavior change (e.g., Forcehimes, 2004; Krentzman, Cranford, & Robinson, 2013). For example, spirituality has been shown to be important for individuals diagnosed with HIV who decided to make positive behavior change after receiving their HIV diagnosis (Kremer, Ironson, & Kaplan, 2009). Further, spirituality was identified as a factor that contributed to one's exit from prostitution among African American women (Valandra, 2007). Despite these empirical findings, however, college students did not identify spiritual changes as important processes of recovery of hitting bottom. Accordingly, spiritual processes may be an important aspect of a change for a variety of behaviors, but may be a process that is distinct from how some individuals change their alcohol use (e.g., it may be an aftereffect of change in alcohol use).

Cognitive appraisal. One element potentially underlying each of the above mechanisms of behavior change is cognitive appraisal of a situation. As Le Berre and

colleagues (2012) noted, one's cognitive processes are "needed to achieve awareness and resolve ambivalence toward alcohol addiction" (p. 1542). Ludwig (1985) found that cognitive processes underlie the maintenance of abstinence from alcohol problems. Further, Sobell and colleagues (2001) found that the cognitive appraisal process was an important precursor to self-change from alcohol and drug problems across cultural setting or substance of abuse. The findings that cognitive appraisal in general may comprise an essential component of recovery from problematic substance use are consistent with other studies (e.g., Blagojević-Damašek, Frenci, Perekovic, Cavajda, & Kovacek, 2012; Cunningham, Wild, Koshi-Jannes, Cordingly, & Toneatto, 2002; Morgenstern & Longabaugh, 2002). Similarly, one's cognitive appraisal of a situation was described by college students (e.g., "when they realize that there is more than what they are doing in life") as one of the most commonly perceived components both in changing one's alcohol use and in one's hitting bottom (i.e., "cognitive appraisal" was a prominently used code).

Cost-benefit analysis. A specific form of cognitive appraisal, cost-benefit analysis, has been shown to be particularly important in the recovery process (Cunningham et al., 1994; Sobell et al., 1993). For example, over half of recovery stories of people who resolved alcohol problems without treatment described a cognitive evaluation of the costs and benefits of their drinking as an important antecedent to recovery (Sobell et al., 1993). Similarly, a cost-benefit analysis was important in the self-resolution of alcohol and other drug problems and perception of high-cost, low-reward was predictive of abstinence among cocaine users (Downey, Rosengren, & Donovan, 2000; Finfgeld, 2000). The importance of weighing the costs and benefits of alcohol use is further apparent in the numerous articles that have developed and evaluated measures

of such decisional balance among a variety of substance using populations (e.g., Collins, Carey, & Otto, 2009; Cunningham, Sobell, Gavi, Sobell, & Breslin, 1997; King & DiClemente, 1993).

Loss of control. Another potentially important cognitive appraisal process underlying substance use behavior change is the perception of a loss of control. The importance of one's sense of control over his or her substance use has been highlighted in several studies across populations (e.g., Blagojević-Damašek, Frenci, Perekovic, Cavajda, & Kovacek, 2012; Blume, Schmaling, & Marlatt, 2006; Forcehimes, 2004; Kaskutas, 1996; Miller, 1985; Umeh & Sherratt, 2013). Specifically, research has found that perceived internal versus external control may be particularly important in the recovery process (e.g., Caster & Parsons, 1977; Edwards, Brown, Duckitt, Oppenheimer, Sheehan, & Taylor, 1987; James, Woodruff, & Werner, 1965). Although there have been some contradictory findings (e.g., Perlman, Bobak, Steptoe, Rose, & Marmot, 2003; Skog & Duckert, 1993), the majority of findings have concluded that perceived loss of control is a common experience for many people who have recovered from substance use problems, which is consistent with college student perceptions' of recovery.

Traumatic "key events." Compared to the previous topics, relatively little research has been conducted to evaluate the role traumatic "key events" play in the behavior change process. However, two studies have found compelling evidence supporting its importance in cessation from alcohol problems. The first of these studies found that successful alcohol use change attempts were associated with traumatic life events (Edwards, Oppenheimer, & Taylor, 1992). In the second study, Matzger and colleagues (2005) interviewed individuals who had recovered from alcohol problems.

They found three things predicted sustained remission from alcohol problems, one of which was the experience of a "traumatic event." Although these studies are limited by their retrospective self-report data collection methods, they point to the potential importance of what one perceives as a traumatic, pivotal event in his or her recovery process. Additionally, "general negative consequences," which included some responses indicating particularly traumatic negative consequences (e.g., "…and traumatic experiences") was one thematic code identified from college student perceptions of the processes underlying recovery from alcohol problems Study 1, Phase 2.

Positive "key events." Similar to the role traumatic "key events" may play in the recovery process, some research suggests that positive events can play an equally important role. For example, becoming pregnant has been viewed by some to be an important, positive "key event" in the facilitation of the cessation of the use of alcohol (Blomqvist, 2002). In that same study, Blomqvist (2002) found that positive "key events" were the second most frequently reported reasons cited for recovery, regardless of whether or not an individual recovered with or without treatment. Edwards and colleagues (1992) also found that participants perceived positive life events as important in the process of changing one's drinking. Therefore, what one perceives as positive "key events" may impact changes in alcohol problems.

Self-efficacy and motivation to change. Although traumatic and positive "key events" have only initial support, self-efficacy and motivation to change are two constructs that have been more thoroughly researched in relation to behavior change.

Motivation. A number of studies have found motivation to change was significantly associated with the initiation of behavior change (e.g., Dyson, 2007;

Klingemann, 1991; Penberthy et al., 2011), including Study 1, Phase 2 analyses of perceptions of the general recovery process where the code "Desire for Positive Change" may reflect one's motivation to change. Despite these numerous supportive findings, however, there are some contradictory findings (e.g., Carpenter, Biele, & Hasin, 2002), which may reflect the complex, dynamic nature of motivational processes involved with substance use behavior change (SAMHSA, 1999). Accordingly, motivation may play an important, but complex role in one's behavior change.

Self-efficacy. Similar to motivation, self-efficacy has also been widely supported as influencing substance use behavior change (e.g., DiClemente, Doyle, & Donovan, 2009; Prochaska, DiClemente, Velicer, Ginpil, & Norcross, 1985; Strecher, McEvoy DeVellis, Becker, & Rosenstock, 1986). However, as with motivation, there are some contradictory findings (e.g., Forcehimes & Tonigan, 2008), indicating that further research is needed to determine when self-efficacy matters and for whom. Accordingly, self-efficacy may or may not be related to the underlying processes involved with hitting bottom relating to behavior change.

Gender differences. The inconsistency of findings for some of the above constructs' roles in the process of changing one's drinking highlights the complexity of this process and the need to determine which constructs matter most under which circumstances, and for whom. Gender differences are a particularly well-documented example of this multidimensional nature of behavior change. Specifically, research has demonstrated gender effects for the influence of some constructs on the behavior change process. Dawson and colleagues (2005), for example, found odds ratios for recovery from alcohol dependence were influenced by gender. Moreover, the reasons individuals cite as

antecedents for alcohol dependence recovery vary by gender (Bischof, Rumpf, Hapke, Meyer, & John, 2000; Jakobsson, Hensing, & Spak, 2008). Accordingly, it may be important to consider the complex interplay between a variety of individual characteristics and environmental factors when examining the process of alcohol use behavior change.

Study 1 Discussion

Results from Study 1 indicate that many factors may precipitate change in substance use. Such variables include inter- and intrapersonal factors such as family problems and physical health problems, as well as environmental factors, existential issues, and cognitive appraisal. Each of these variables may combine in different ways to influence the recovery process, and other factors such as motivation, self-efficacy, and gender may be contribute to this process. One explanation for this complex behavior change process may be found in the role of hitting bottom, which allows for a combination of factors to influence behavior change, including the synergistic importance of interpersonal problem severity in combination with one's cognitive appraisal of a situation, for example. Many of these factors were identified in both phases of Study 1, suggesting consistency in which factors may precede recovery from substance use disorders, as well as perceptions among college students regarding factors that may be part of or relevant for hitting bottom. Specifically, social network factors, health problems, environmental and existential factors, and cognitive appraisal were identified by individuals who recovered from substance use disorders, from empirical research studies, and from college student perceptions of the processes of drinking behavior change.

In summary, Study 1 was used to establish theoretical underpinnings of the construct of interest by identifying important mechanisms of behavior change that may comprise hitting bottom. The factors identified by the phases of Study 1 were used to inform potential dimensions to be assessed within a measure of items important to

recovery from and hitting bottom for alcohol problems: the Noteworthy Aspects of Drinking Important to Recovery (NADIR) measure.

Study 2: Measure Development and Administration

Phase 1: Measure Development and Revision

As noted above, results from Study 1 informed the creation of question items included in the preliminary measure of hitting bottom, called the Noteworthy Aspects of Drinking Important to Recovery (NADIR) measure. Literacy and reading levels were considered when generating each of the question items, as suggested by Holmbeck and Devine (2009). Specifically, the NADIR measure was developed with the aim of achieving no greater than an 8th-grade reading level in the final measure (DeVellis, 2012). The question items consisted of Likert-type response options (0 = False; 1 = Somewhat true; 2 = Mostly true; 3 = Definitely true) covering a variety of factors comprising hitting bottom (see Table 5 for preliminary NADIR measure, with labels for each life domain). These response options were chosen so a response of "False" would represent a true zero value (as opposed to response options with varying degrees of falseness or truth). Additionally, a minimum of 4 items for each identified life domain of hitting bottom were generated, to avoid underdetermination of each factor of interest (Fabrigar, Wegener, MacCallum, & Strahan, 1999). To assess whether or not an individual views life domains as related to drinking, wording of some items allow the individual to endorse a life domain (e.g., "physical health problems") with or without cognitive appraisal of drinking's role in that life domain. Further, to assess if an individual is bothered by or influenced by a life domain, each life domain's importance, or how bothersome the life domain is, and influence on change also was assessed. These cognitive appraisal, bothersome-ness/importance, and influence on change nuances are highlighted in Table 5.

As a secondary aim of Study 1, Phase 1, the literature review phase identified experts in the field of addiction recovery (see Table 6). In Study 2, Phase 1, identified experts were contacted to provide feedback on the preliminary NADIR measure. Each expert was identified by having at least one publication that was highly relevant to the present study of hitting bottom or by having more than one publication related to the addiction recovery process more generally. To receive feedback from experts in the field, the present study obtained approval from the Institutional Review Board of the University of New Mexico and experts were invited to participate in this phase of the present study. Experts received an email invitation to provide feedback on the preliminary measure of hitting bottom via phone, email, online survey, mail, and/or in-person (if applicable). This feedback was used to modify the initial NADIR measure of hitting bottom to more accurately capture the construct and improve the measure (see Table 7 for the final, 114-item measure).

Phase 2: Measure Administration

Participants. Participants in Study 2, Phase 2 were recruited from two primary sources: Amazon Mechanical Turk (MTurk; Buhrmester, Kwang, & Gosling, 2011) and Craigslist. A total of 402 participants were recruited from these resources (N = 402) with 196 (n = 196) recruited from MTurk at a reimbursement rate of up to $1.50 per respondent. A total of 97 participants were recruited from the Albuquerque Craigslist to be entered to win one of five $25 gift card prizes or one $100 gift card prize. Similarly, a total of 109 participants were recruited from Craigslist in major cities across the United States and were entered to win one of five $25 gift card prizes or one $100 gift card prize, separate from the prizes available to Albuquerque respondents. The cities for the

nationwide Craigslist ad were based on the study sites from the COMBINE Study and Project MATCH (Anton et al., 2006; Project MATCH Research Group, 1998) and included Boston, MA; Charleston, SC; Houston, TX; Philadelphia, PA; Los Angeles, CA; Miami, FL; and Seattle, WA. Overall participant demographics are described in Table 8 and site-specific demographics are described in Table 9. All participants were 18 years or older, provided electronic consent to participate, were fluent in English, had consumed alcohol within the past 30 days, and self-identified as current moderate to heavy drinkers. Additionally, all data collection procedures were approved by the Institutional Review Board of the University of New Mexico.

Drinking Severity Measures. In addition to basic demographic data, participants were asked to respond to measures of drinking intensity and alcohol-related consequences. Specifically, a version of the Daily Drinker Questionnaire (DDQ; Collins, Parks, & Marlatt, 1985) was used to assess how many standard drinks (e.g., one 12-ounce can or bottle of beer) participants consumed for each day of the week and over how many hours for a "typical" drinking week and the "heaviest" or "peak" drinking week for the past 30 days. The Short Inventory of Problems (SIP-2L; Blanchard, Morgenstern, Morgan, Labouvie, & Bux, 2003; Miller, Tonigan, & Longabaugh, 1995) is a 15-item, dichotomous (i.e., "yes" or "no") assessment of alcohol-related consequences. Alcohol-related consequences also were assessed via the 10-item Alcohol Use Disorders Identification Test (AUDIT; Saunders et al., 1993) and the 114-item NADIR measure developed in the present study (see Table 7). Internal consistency of the SIP and AUDIT in the current sample were $\alpha = 0.89$ and $\alpha = 0.86$, respectively. These assessments were

administered to examine if participants who self-identified as "moderate to heavy drinkers" also endorsed problematic alcohol consumption and related consequences.

Data Preparation. For the purpose of creating statistical models that accurately represented the data and to avoid creating pseudo-factors, two primary methods were employed to remove items that contributed poorly to the model. Importantly, the 114-item original NADIR measure was created to purposefully have items that attempted to measure the same latent variable (e.g., family problems) so exploratory factor analysis (EFA) and item response theory (IRT) could be used to retain only the strongest items for each latent variable. Accordingly, EFA and IRT were used to remove items that contributed weakly to the primary factor (identified via EFA) and to remove items with poor item difficulty and item discrimination for that latent trait (via IRT; DeVellis, 2012). Consequently, two primary approaches were used to find the best fitting model for the data, EFA and IRT, which were followed by confirmatory factor analysis (CFA) for each model.

Data Analysis. EFA, IRT, and CFA all were conducted using Mplus version 7.1 (Muthén & Muthén, 2012). Principal axis factoring (PAF) extraction was used for the EFA. Items in the EFA were specified as categorical and a geomin rotation (an oblique rotation) was used to allow for correlations between factors. We then used the EFA to inform the model tested in the CFA. The number of factors to be estimated in the CFA was based on the change in model fit for each additional factor in the EFA and the Kaiser rule of each factor having an eigenvalue greater than 1.0 (Kaiser, 1960; see Table 10 for Eigenvalues). Additionally, we performed parallel analyses for the number of items in

each EFA to assure the number of factors extracted did not exceed the number of factors that could be expected by chance alone (see Figure 1; Zwick & Velicer, 1986).

For the IRT, item characteristic curves (ICCs) were used to judge each item's discrimination and difficulty and items with poor discrimination and difficulty were removed from the model (see Figure 2). Item discrimination is represented by the slope of the ICC where ICCs with steeper slopes do a better job discriminating on a given characteristic. For the present study, poor item discrimination was conceptualized as that item being weakly related to the latent construct of hitting bottom. Item difficulty is how much of a given characteristic is required to endorse an item. In the present study, item difficulty was conceptualized as how severe one's alcohol problems must be to endorse an item on the NADIR measure (e.g., experiencing a hangover would have lower item difficulty than losing one's job due to drinking). Accordingly, items with poor item difficulty would have ICCs located lower or higher along the X-axis of Figure 2, representing items with lower and higher item difficulty. Consequently, items with ICCs spread across the X-axis or with slopes that deviated from the majority of items were removed (see Table 11 and Table 12 for retained and removed items, respectively).

The CFAs were based on results from the EFA and IRT in addition to the anticipated components of hitting bottom on which the NADIR measure was based. The CFAs also used the categorical items and the weighted least squares means and variances estimator with Delta parameterization. Model fit of the CFA was evaluated using the root mean square error of approximation (RMSEA), the comparative fit index (CFI), and Tucker-Lewis index (TLI). Models were considered to provide an adequate fit to the data with RMSEA < 0.08 (Browne & Cudeck, 1993) and CFI > 0.90 (Bentler, 1990).

Study 2: Results

Preliminary Analyses

Descriptive analyses indicated the overall sample drank an average of 29.8 drinks on a typical week and 40.8 on a heavy drinking week with an average of approximately 5 drinking days per week for both typical and heavy drinking weeks (see Table 8). Moreover, the average summary SIP score was 7.6 out of 15 alcohol-related consequence items, indicating the overall sample experienced a number of alcohol-related consequences. This finding is similar to the overall average AUDIT summary score of 16.3, which was more than twice the summary score of 8 that is often considered indicative of hazardous alcohol use (Babor, Higgins-Biddle, Saunders, & Monteiro, 2001). As described in Table 9, descriptive statistics of drinking variables suggested participants from each recruitment site had high levels of alcohol consumption in both quantity and frequency, and experienced a number of alcohol-related consequences as measured by both the SIP and the AUDIT. Additionally, approximately 33%-47% of the sample from each recruitment site had ever attended formal or informal treatment (e.g., self-help groups) for substance use. Accordingly, the overall sample appears to be representative of individuals experiencing a number of alcohol-related problems.

One-way ANOVAs were performed to examine any significant differences in drinking variables by site (i.e., Albuquerque, MTURK, and nationwide recruitment sites). Summary scores of the AUDIT did not differ significantly between sites (F (2, 382) = 2.89, p = 0.057), but SIP scores (F (2, 365) = 6.89, p = 0.001), and total drinks per typical and peak week did differ significantly by site (typical: F (2 332) = 5.46, p = 0.005; peak: F (2, 323) = 4.152, p = 0.017). However, Levene tests for homogeneity of variance

(HoV) indicate the HoV assumption for ANOVA was violated for total drinks in a typical week, total drinks in a peak week, and the number of drinking days in a peak week, so these significant differences by site should be interpreted cautiously. Further, given the sample size required for factor analyses, and given the fact that each site individually yielded samples experiencing potentially hazardous alcohol use per SIP and AUDIT scores, we considered the overall sample adequate for the factor analyses.

Exploratory Factor Analyses and Item Response Theory Models

First, a preliminary EFA was conducted to examine the possible number of factors comprising the NADIR measure. Factors 1-14 yielded eigenvalues > 1.0 (see Table 10), but convergence was problematic when greater than four factors comprised the model. Moreover, parallel analysis of a 114-item measure with $N = 402$ suggested eight or more factors would be found due to chance alone, so models that contained more than seven primary factors were not considered for the following analyses.

Results from the EFA also suggested a single factor (with eigenvalue = 59.898) was largely driving the measure (see eigenvalues in Table 10). The first factor eigenvalue suggested that most of the variance was explained by one dimension and thus unidimensionality, a requirement of IRT, was assumed. We then used IRT analyses to remove items whose ICCs deviated from the majority of the items (see Figure 2 for before and after ICCs). Based on these ICCs, we removed 54 items, leaving 60 of the original 114 items (see Table 11 and Table 12 for retained and removed items, respectively). Some of the remaining items loaded weakly or negatively on the cognitive appraisal and importance/influence factors; therefore, items 10, 23, 24, 31, 32, 33, 34, 53, and 54 were removed from the cognitive appraisal factor and items 37, 38, 67, 68, and 94

were removed from the importance/influence factor and remained only on their life domain factors rather than additionally in the higher-order factors (see Table 11 for final, 60-item measure and factor loadings).

Confirmatory Factor Analyses

With the remaining 60-items, we tested a CFA model that was based on the conceptualization behind the development of the original NADIR measure. Specifically, we conceptualized the various domains of the NADIR measure as comprising the factors and tested a model with 4 primary factors (a social network factor, a health problems factor, a situational and environmental circumstances factor, and an existential issues factor) and 3 higher-order factors (a cognitive appraisal factor, a factor for items that measured how important or bothersome each life domain was, and a factor for items that measured how influential each life domain was for changing one's drinking). However, results from this model suggested the higher-order factors of importance/"bothersomeness" and influence were highly correlated ($r > 0.90$), so we combined those two factors into one higher-order factor. Accordingly, the final IRT-driven CFA model tested included four consequence domain factors (social network, health problems, situational and environmental circumstances, and existential issues) and two higher-order factors (cognitive appraisal, importance of the life domain and how influential the life domain was over one's drinking; see Table 11). Results from the CFA suggested this model provided adequate fit to the observed data ($\chi 2$ (1770) = 78341.969, $p < 0.001$; RMSEA = 0.06 (90% CI: 0.065, 0.068; CFI = 0.962; TLI = 0.959).

Psychometrics and Concurrent Validity of Final Measure

The internal consistency of the 60 item measure was excellent ($\alpha = 0.985$; see Table 13 for individual item internal consistency). In addition, the internal consistency reliability of the four domain factors was also excellent (social network: $\alpha = 0.973$; health: $\alpha = 0.945$; situational/environmental: $\alpha = 0.956$; and existential: $\alpha = 0.944$) as was the internal consistency of each of the higher order factors (cognitive appraisal: $\alpha = 0.966$; importance/influence: $\alpha = 0.946$).

Pearson correlations between the factors of the final CFA model with drinking quantity and frequency, SIP scores, and AUDIT scores were all significant (see Table 14), with associations ranging from small correlations ($r = 0.109$ to $r = 0.243$) between the NADIR factors and number of drinking days in a peak week to very large correlations between the NADIR factors and the SIP and AUDIT scores ($r = 0.612$ to $r = 0.781$). Interestingly the higher order cognitive appraisal factor was the NADIR factor that was most strongly correlated with the SIP ($r = 0.742$) and AUDIT ($r = 0.781$) scores. Information regarding the correlations between factors is presented in Table 15.

Differences by Gender and Treatment History

A final set of analyses were conducted to examine differences in factor scores on the NADIR measure by gender and history of any treatment seeking. Results indicated women tended to score higher on the factors and the differences were significantly higher for all factors except the social network factor and the situational and environmental circumstances factor (see Table 16). Similarly, individuals with a history of any formal or informal substance use treatment scored significantly higher on all factors (see Table 16).

Study 2: Discussion

Results from the factor analysis process of Study 2, Phase 2 indicated acceptable fit of a conceptually driven factor structure comprised of 60-items from the NADIR measure. Specifically, there were four domain factors and two higher-order factors. The first domain factor was conceptualized as a "social network" factor and was comprised of items that were created to assess for family problems and social pressure to get help with one's drinking (e.g., "My drinking has hurt my family" and "People say I need help with my drinking"). The second domain factor was "health problems," which included items indicating problems with physical health as well as psychological and emotional health (e.g. "I know my drinking is making me sick" and "Because of my drinking, I struggle to control my emotions"). The third domain factor was characterized by situational and environmental circumstances related to one's drinking, including financial, employment, housing, and legal problems (e.g., "I have a lot of debt because of my drinking"). The fourth domain factor was "existential issues," which consisted of identity and values conflict items (e.g., "I don't recognize the person I am when I drink").

The "cognitive appraisal" higher-order factor consisted of items that indicate an individual has cognitively appraised his or her drinking as problematic, or is currently considering that possibility. This factor includes items from the first four domain factors; for example, the item "I fight with members of my family because of my drinking" indicates problems in the "social network" factor but also suggests one has cognitively appraised his or her drinking as related to negative consequences (i.e., family problems). Additionally, the "cognitive appraisal" factor consists of items related to a cost-benefit analysis of one's drinking, a traumatic "key" event, and motivation and self-efficacy

regarding changing one's drinking. The second higher-order factor represents a combination of items initially developed to assess how important or bothersome a domain was to an individual and items to assess how much a domain influenced one to consider changing his or her drinking. Accordingly, this factor is conceptualized as an "importance/influence" factor and consists of items such as "I am bothered by problems with my job caused by my drinking" and "Problems with my job make me think about changing my drinking." These higher order factors differentiate the NADIR measure from other existing measures of alcohol-related consequences, which tend to focus on domains of problems rather than an individual's appraisal of those problems.

Based on these results, the NADIR measure appears to assess hitting bottom as the construct was conceptualized from findings in Study 1 (Phases 1 and 2) and Study 2, Phase 1. Specifically, the results from Study 2, Phase 2 suggest hitting bottom is comprised of social network issues, health problems, situational and environmental circumstances, and existential issues combined with cognitive appraisal and how important or influential life domains are to the individual. However, many of the 114-items originally comprising the NADIR measure were removed to facilitate model fit, including all 4 items that were added after Study 2, Phase 1 to assess changes in role obligation. Although each of these items failed to contribute meaningfully to the CFA model, it is important to note that these items were added as the opinion of one expert rather than as a result of the findings from both phases of Study 1. However, all items from the social support, spiritual change, and positive "key" event domains also were removed, as were most items from the motivation and self-efficacy domains. Each of these domains included items that were more positive (e.g., "Something good has

happened that made me realize I should change my drinking") than the domains whose items remained largely intact (e.g., physical health problem domain items). Moreover, the original, 114-item NADIR measure was created with the intention to later remove weaker items within each domain and included a purposefully wide array of life domains that may be important in the recovery process, but less important to hitting bottom specifically (e.g., spiritual change). Accordingly, the anticipated components of hitting bottom remained largely intact, with the exception of the positive event life-domains, despite removing over half of the items from the original 114-item measure.

In addition to retaining conceptually driven domains, the final NADIR measure displayed excellent psychometric properties for the present sample. Specifically, internal consistency reliability in the current sample for the overall 60-item measure, as well as each of the six factor subscales, was all $\alpha > 0.90$. Moreover, each of the six factors in the 60-item NADIR measure were correlated with drinking quantity and frequency, as well as total SIP and AUDIT scores, demonstrating good concurrent validity.

Limitations and Strengths

A limitation to the development of the NADIR measure for hitting bottom was that not all invited experts from Study 2, Phase 1 provided feedback regarding the initial measure. Accordingly, important domains underlying the construct of hitting bottom may have been overlooked and the wording of existing items of the NADIR measure may not have been ideal. For example, the spiritual change domain did not remain in the final 60-item NADIR measure, which may have been due to the wording of the items to represent spiritual change rather than spiritual emptiness (e.g., "I lost faith because of my drinking") where the former may represent a process that is important for general

recovery and the latter may be important for hitting bottom more specifically. Further, additional research could have been done to see how the present results map onto experiences of individuals who are currently experiencing a number of negative consequences from their drinking while still not resolving their alcohol problems. However, the present study utilized a multi-method approach to identifying components of hitting bottom (i.e., literature review, synthesized success stories from QuitAndRecovery.org, and analyzed college student perceptions of hitting bottom), which captured a wide array of potential components of hitting bottom. Moreover, these limitations are somewhat reconciled by the fact that several of the identified experts (N = 9; 11% Female) did provide feedback on the preliminary measure, and that redundancy was built into the original measure to increase the likelihood that existing items would measure the intended life domain and items that contributed less to the measure could be removed without removing the life domain altogether. The removal of the domains of social support, spiritual change, and a positive "key" event, may be indicative of items that failed to accurately assess these domains or that these domains are less fundamental to the construct of hitting bottom.

One limitation to the factor analyses is the sample size needed to establish stable factor structure of the NADIR measure exceeded the sample collected. Specifically, Bentler and Chu (1987) suggest a minimum ratio of 5 participants per parameter estimated when examining factor structure. There were 295 parameters estimated in the final model, so a sample size of at least $N = 1475$ would be necessary. Moreover, one-way ANOVA results suggested differences in drinking variables by recruitment site and combining the sample for factor analytic purposes may have overlooked potential

differences in the factor structure of the NADIR measure based on drinking problem severity. However, the *N* = 402 obtained in Study 2, Phase 2 provides initial evidence for the factor structure of the NADIR measure. Furthermore, data collection is on-going and the factor structure modeled in the present manuscript will be investigated with larger sample sizes to test for stability of the final model (i.e., the IRT-driven CFA model).

Another limitation of the current study is that web-based data collection restricted the number and length of measures we could administer without overburdening participants. Future research should be conducted to include measures of the stages of change identified in the TTM as well as the full Drinker Inventory of Consequences (DrInC; Miller, Tonigan, & Longabaugh, 1995) rather than the shorter SIP measure used presently. In addition to providing richer information about how the NADIR measure relates to existing measures, the inclusion of a measure of stages of change could be used to examine the discriminant validity of the NADIR measure especially considering hitting bottom may be conceptualized as related to more motivated stages of change (e.g., Action) and explicitly less related to less motivated stages of change (e.g., Precontemplation).

Despite the above limitations, the present study has numerous strengths. For example, Phase 2 of Study 2 consisted of a demographically diverse sample across multiple cities in the United States. Moreover, participants in Phase 2 of Study 2 identified as current "moderate to heavy drinkers" rather than individuals who might identify as "alcoholics" or other labels that fail to capture the heterogeneity of individuals who experience alcohol-related consequences. Accordingly, the present findings may be more generalizable to a variety of individuals who experience alcohol problems.

However, the present study did not examine how the factor structure of the NADIR measure may or may not differ between men and women. Since gender was identified as a variable that has been demonstrated to influence the recovery process (see Results from Study 1), future research with sufficient sample size should examine possible effects of gender to build upon the present study's findings.

Another strength from Phase 2 of Study 2 is that the final model from this phase is based on the conceptualization that comprised the development of the NADIR measure. Moreover, IRT was used to objectively determine which items to remove from the original measure. To this end, the final model is backed by both research-driven conceptualization of factors and by data-driven methods (i.e., IRT). Consequently, the final model of the factor structure of the NADIR measure represents a convergence of evidence and makes sense from both concept and data perspectives.

Overall Discussion

The present study used a variety of methods to develop a measure of hitting bottom, including literature review, preliminary data collection, expert consensus, and measurement administration. Accordingly, the Noteworthy Aspects of Drinking Important to Recovery (NADIR) measure represents a convergence of evidence of what domains comprise the construct of hitting bottom. The factor structure of this measure was largely consistent with the expected components of hitting bottom where social network variables, health problem variables, situational and environmental circumstances, and existential issues, in combination with cognitive appraisal and the importance and relevance (or influence) of each of those variables comprised the factor structure of the measure of hitting bottom. Importantly, the latter two factors distinguish the NADIR measure from existing measures of alcohol-related consequences.

With these important steps undertaken to develop this measure of hitting bottom, future research can be conducted to test the predictive validity of the NADIR measure. Additionally, future research should examine if and how gender may impact hitting bottom. Accordingly, future research may be able to help us understand if hitting bottom is important in recovering from an alcohol use disorder (AUD), and for whom. Moreover, the individual life domains comprising hitting bottom may highlight the importance of a variety of variables in recovering from an AUD, such as family problems and cognitive appraisal. Such information may be incorporated into existing interventions that currently do not address the breadth and interconnectedness of such domains that are characteristic of conceptualizations of hitting bottom.

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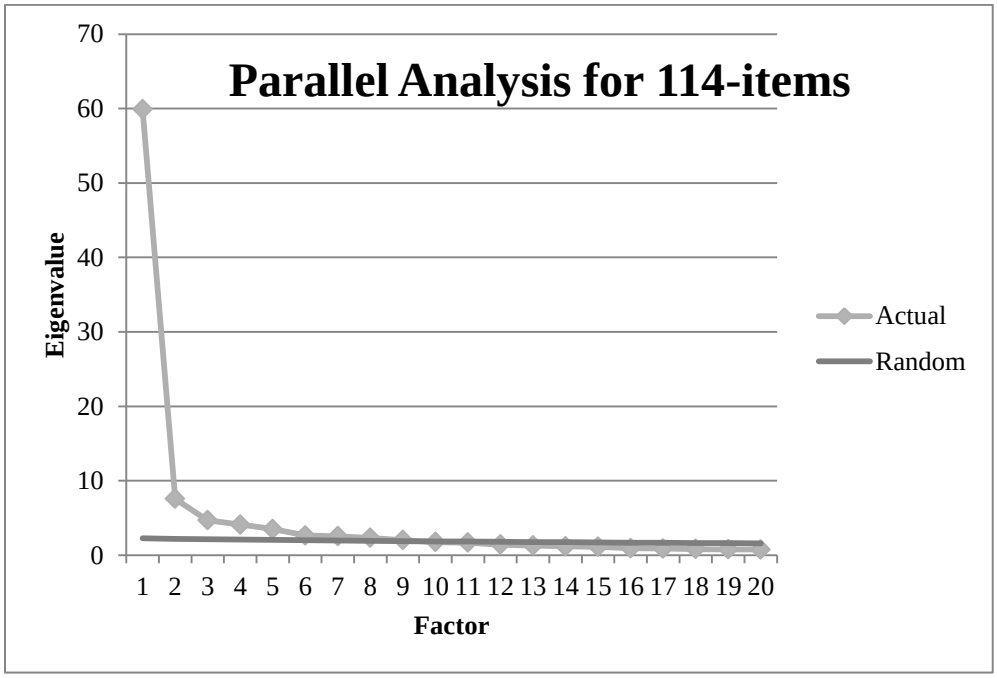

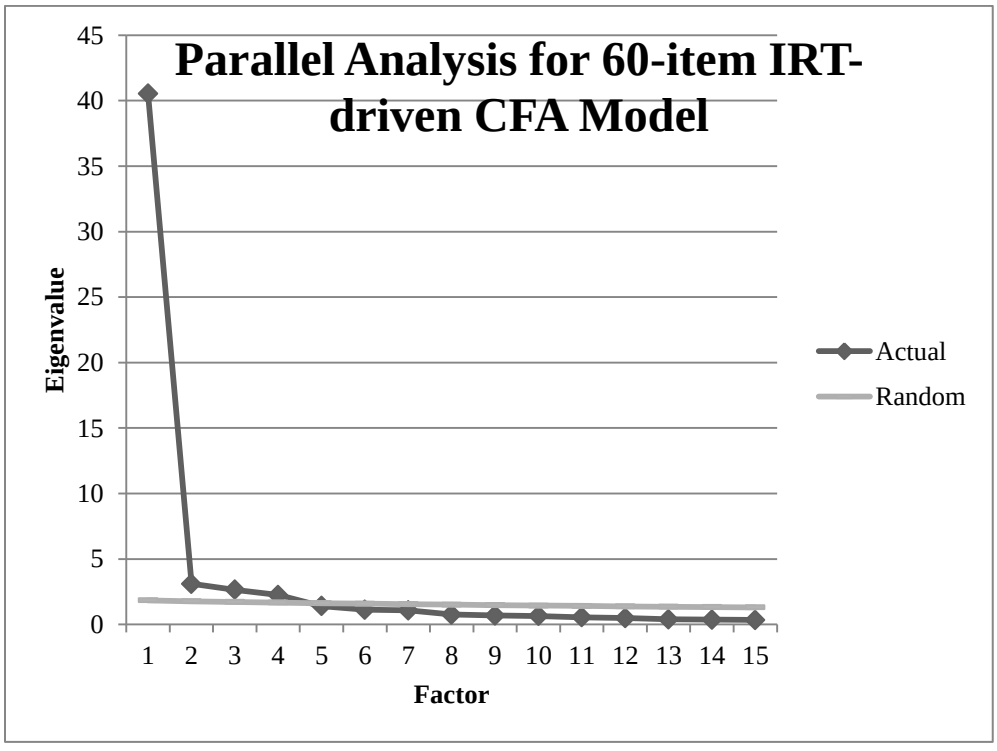

Figure 1. Parallel analyses for the original 114-item NADIR measure and the reduced model tested via CFA.

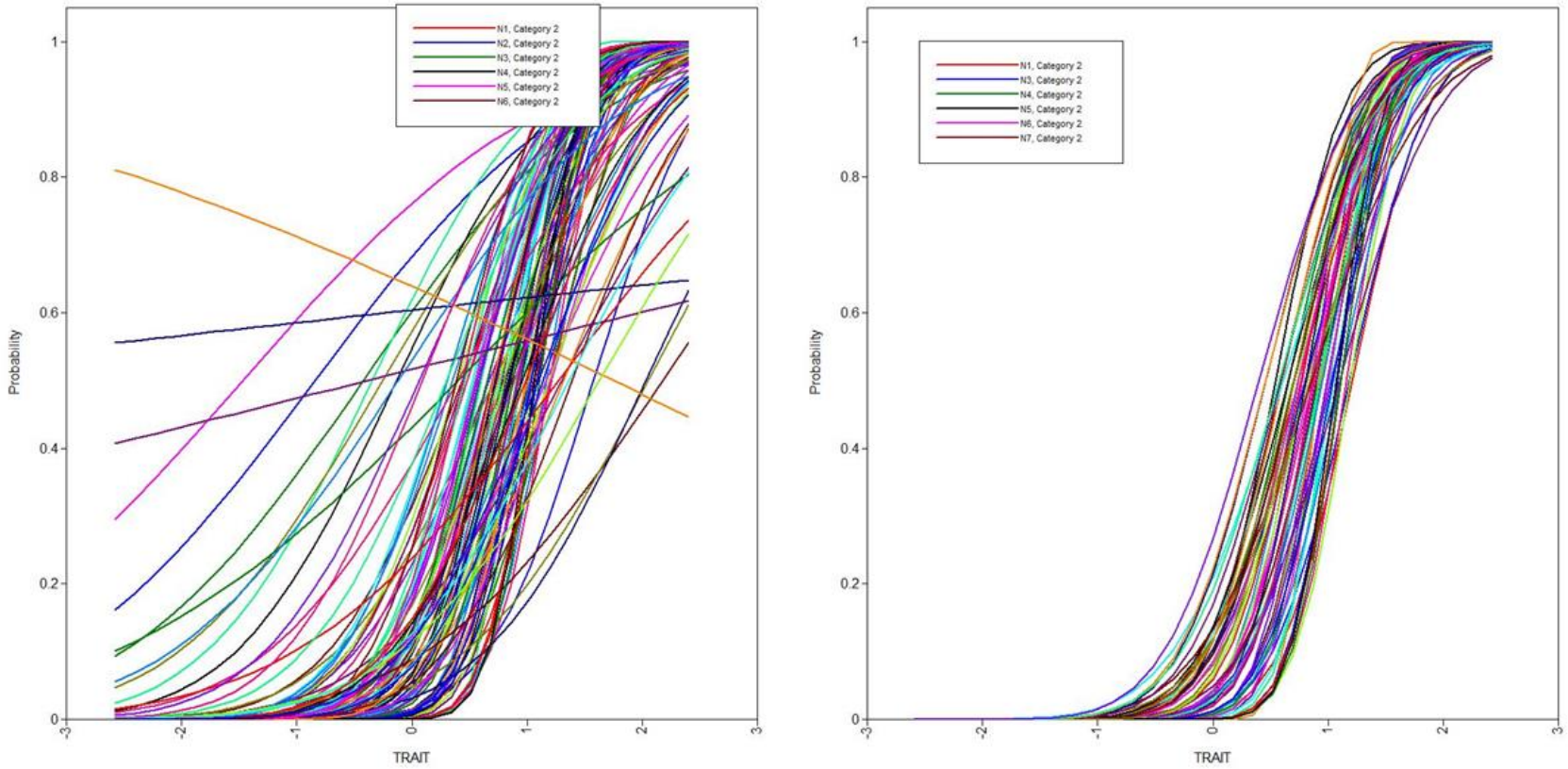

Figure 2. Item Characteristic Curves (ICCs) from IRT analyses: left are the original, 114-item NADIR measure's ICCs; right are the 60-item NADIR measure's ICCs.

Table 1

Search Terms for Literature Review (Study 1, Phase 1)

“rock bottom”
“hit bottom”
“high bottom”
“tipping point” AND alcohol
“tipping point” AND addiction
“tipping point” AND substance use
“tipping point” AND substance abuse
“tipping point” AND drugs
“behavior change” AND alcohol
“behavior change” AND addiction
“behavior change” AND substance use
“behavior change” AND substance abuse
“behavior change” AND drugs
“reasons for behavior change” AND alcohol
“reasons for behavior change” AND addiction
“reasons for behavior change” AND substance use
“reasons for behavior change” AND substance abuse
“reasons for behavior change” AND drugs
“mechanisms of behavior change” AND alcohol
“mechanisms of behavior change” AND addiction
“mechanisms of behavior change” AND substance use
“mechanisms of behavior change” AND substance abuse
“mechanisms of behavior change” AND drugs
“positive life events” AND “behavior change” AND alcohol
“positive events” AND “behavior change” AND alcohol
“negative events” AND “behavior change” AND alcohol
motivation AND “behavior change” AND alcohol
“readiness to change” AND alcohol
“eliciting change talk”
“spontaneous remission” AND alcohol
“self-help” AND “behavior change” AND alcohol
“cognitive appraisal” OR “cognitive evaluation” AND alcohol AND “behavior change”
“resiliency” AND alcohol AND “behavior change”
“loss of control” AND alcohol AND “behavior change”
“locus of control” AND alcohol AND “behavior change”
snowball AND alcohol AND “behavior change”
“escalation of problems” AND alcohol AND “behavior change”
“treatment seeking factors” AND alcohol
“help-seeking” AND alcohol AND “behavior change”
“subjective evaluation” AND alcohol AND “behavior change”
“re-evaluation” AND alcohol AND “behavior change”
“ambivalence resolution” AND alcohol AND “behavior change”
“functional significance” AND alcohol AND “behavior change”

“rock bottom” AND “recovery”
“rock-bottom concept” (in Psychology)
“rock-bottom concept” (in Addictions)
“hitting bottom in addictions”
“define hitting bottom”
“rock bottom” in addiction
historical evolution of the concept of “rock bottom”
“rock bottom” AND “addiction history”
“spontaneous remission”
“Benjamin Rush”
“Jellinek”
“The Oxford Group”

Table 2
Participant Descriptives from Study 1, Phase 2

		N = 75
Variable	Descriptive statistic	M (SD) or N (%)
Age		20.3 (5.1)
Gender	Female	54 (72.0%)
Class Standing		
	Freshman	44 (58.7%)
	Sophomore	15 (20.0%)
	Junior	10 (13.3%)
	Senior	6 (8.0%)
	Graduate Student	0 (0.0%)
Race		
	American Indian or Alaska Native	9 (12.0%)
	Asian	9 (12.0%)
	Black or African American	2 (2.7%)
	Native Hawaiian or Pacific Islander	1 (1.3%)
	White or Caucasian	43 (57.3%)
	Other	9 (12.0%)
Ethnicity (Hispanic)		37 (49.3%)
% non-drinkers		44 (58.7%)
Typical # of drinks per week[a]		5.4 (5.2)
Peak # of drinks per week[a]		9.0 (8.1)

***Note*.** Multiple responses were allowed for Race. [a] For drinkers only (i.e., consumed alcohol at least once in the past 30 days).

Table 3
Perceived Processes of Alcohol Use Recovery Ranked in Order of Frequency from Study 1, Phase 2

Rank	Thematic code	Examples	Frequency	%
1	Cognitive Appraisal	"When they realize they have a problem"	23	13.7
2	Family	"Family/relationship issues caused by alcohol use"	22	13.1
3	Affecting Life	"It is costing them their life"	16	9.5
4	Other	"An intervention"	13	7.7
5	Affecting Others	"Acknowledge that they are hurting others"	11	6.5
6	Desire for Positive Change	"They want to make a change in their life"	10	6
7	General Negative Consequences	"They get into bad situations"	10	6
8	Health (general)	"When it becomes a danger to their health"	8	4.8
9	Addiction/Alcoholism	"Addiction"	7	4.2
10	Friends	"Friends"	7	4.2
11	Relationships (general)	"Relationship issues caused by alcohol use"	6	3.6
12	Violence/Danger	"Use of violence"	5	3
13	Invalid	"For fun"	4	2.4
14	Physical Health	"Physical health hazards"	4	2.4
15	Spouse/Significant Other	"Their marriage may be going downhill"	4	2.4
16	"Bottom"	"They finally hit rock bottom"	3	1.8
17	Goal Interference	"They realize it is not helping them reach their goals"	3	1.8
18	Mental Health	"Need to improve mental health"	3	1.8
19	Depression	"When they are depressed due to alcohol"	2	1.2
20	Finances/Money	"Financial loss"	2	1.2
21	Housing	"Losing housing"	1	0.6
22	Job/Employment	"They realize it is affecting their job"	1	0.6
23	Loss of Control	"Feeling powerless"	1	0.6
24	Physiological Dependence	"They are unable to function throughout the day without drinking alcohol"	1	0.6
25	Quantity	"Their overuse"	1	0.6

Table 4
Perceived Processes of "Hitting Bottom" Ranked in Order of Frequency from Study 1, Phase 2

Rank	Thematic code	Examples	Frequency	%
1	Loss of Something or Someone	"Losing someone important"	20	13.5
2	Other	"It's a wake up call"	18	12.2
3	Family	"Splitting up your family"	12	8.1
4	Invalid	"Unsure"	11	7.4
5	Depression	"When you feel depressed"	10	6.8
6	General Negative Consequences	"Embarrassing situations"	9	6.1
7	Affecting Life	"Losing grasp of your life"	8	5.4
8	Cognitive Appraisal	"Realize you have a problem"	8	5.4
9	Finances/Money	"Creating massive debt"	6	4.1
10	Health (general)	"Health reasons"	4	2.7
11	Hopelessness	"Giving up on overwhelming situations"	4	2.7
12	Loss of Control	"Loss of self control"	4	2.7
13	Suicidal Ideation	"Life not worth living anymore"	4	2.7
14	Violence/Danger	"Hurting someone, hurting yourself"	4	2.7
15	Frequency	"Drinking or getting high daily"	3	2.0
16	Job/Employment	"To be unemployed"	3	2.0
17	Relationships (general	"Lose relationships"	3	2.0
18	Emotional Problems	"They are completely emotionally drained"	2	1.4
19	Friends	"No friends"	2	1.4
20	Loss of Self	"They lose themselves"	2	1.4
21	Mental Health	"Worry"	2	1.4
22	Physiological Dependence	"Can't go 24 hours without consuming mass amounts of alcohol"	2	1.4
23	Quantity	"Overdose"	2	1.4
24	Addiction/Alcoholism	"Alcoholism"	1	0.7
25	Goal Interference	"Loss of things that motivate them"	1	0.7
26	Housing	"To be homeless"	1	0.7
27	Physical Health	"Almost dying"	1	0.7
28	Spouse/Significant Other	"Disasters like divorce"	1	0.7

Table 5

Life Domains and Preliminary NADIR Measure. Response options (not shown) were "False," "Somewhat True," "Mostly True," and "Definitely True."

Life domain	Item
Family Problems	
Cognitive appraisal	I fight with members of my family because of my drinking.
Cognitive appraisal	Members of my family do not talk to me because of my drinking.
Cognitive appraisal	I have lost relationships with members of my family because of my drinking.
Cognitive appraisal	My drinking has hurt my family.
No cognitive appraisal	Members of my family tell me they dislike my drinking.
No cognitive appraisal	Members of my family have told me my drinking negatively affects them.
Bothersome	I am bothered by problems with members of my family caused by my drinking.
Influence on change	Problems with members of my family make me think about changing my drinking.
Social Pressure and Support	
Cognitive appraisal	My drinking has made people pressure me to get help.
Cognitive appraisal	As a result of my drinking, people have told me to go to treatment.
Cognitive appraisal	People talk about me needing to go to treatment for my drinking.
Cognitive appraisal	I know my drinking makes people want me to go to treatment.
No cognitive appraisal	People say I need help with my drinking.
No cognitive appraisal	People pressure me to reduce my drinking.
Bothersome	I am bothered by problems I have with other people regarding my drinking.
Influence on change	Problems I have with people make me think about changing my drinking.
No cognitive appraisal	My friends and loved ones are supportive of me getting help with my drinking.
No cognitive appraisal	My friends and loved ones would be here for me if I got help with my drinking.
No cognitive appraisal	My friends and loved ones are available and willing to help me reduce my drinking.
No cognitive appraisal	My friends and loved ones are supportive of me changing my drinking.
Bothersome	Support from my friends and loved ones is important to me.
Influence on change	Support from my friends and loved ones makes me think about changing my drinking.

Physical Health Problems	
Cognitive appraisal	I know my drinking is making me sick.
Cognitive appraisal	My health has suffered because of my drinking.
Cognitive appraisal	Because of my drinking, I am not as healthy as I should be.
Cognitive appraisal	My drinking is killing me.
No cognitive appraisal	I've been told drinking is bad for my health.
No cognitive appraisal	A medical professional has told me drinking is unhealthy for me.
Bothersome	Health problems related to my drinking bother me.
Influence on change	Health problems make me think about changing my drinking.
Psychological and Emotional Problems	
Cognitive appraisal	Because of my drinking, I feel sad more often than not.
Cognitive appraisal	My mental health has suffered because of my drinking.
Cognitive appraisal	My drinking has made my emotions out of control.
Cognitive appraisal	My drinking makes me feel mentally ill.
No cognitive appraisal	People have told me that drinking negatively affects my emotions.
No cognitive appraisal	People have told me that drinking negatively affects my mental health.
Bothersome	Emotional/mental health problems related to my drinking bother me.
Influence on change	Emotional/mental health problems make me think about changing my drinking.
Employment, Financial, and Housing Problems	
Cognitive appraisal	My career has suffered because of my drinking.
Cognitive appraisal	My drinking has caused problems with my job.
Cognitive appraisal	I have problems at work because of my drinking.
Cognitive appraisal	I have a lot of debt because of my drinking.
Cognitive appraisal	I have problems with money because of my drinking.
Cognitive appraisal	My financial health has suffered because of my drinking.
Cognitive appraisal	I have problems with housing because of my drinking.
Cognitive appraisal	I can't get stable housing because of my drinking.
Bothersome	I am bothered by problems with my job caused by my drinking.
Bothersome	I am bothered by problems with money caused by my drinking.
Bothersome	I am bothered by problems with housing caused by my drinking.
Influence on change	Problems with my job make me think about changing my drinking.
Influence on change	Problems with money make me think about changing my drinking.
Influence on change	Problems with housing make me think about changing my drinking.
Legal Problems	

Cognitive appraisal	I have been arrested because of my drinking.
Cognitive appraisal	I have had problems with the law because of my drinking.
Cognitive appraisal	My drinking has caused me to commit crimes.
No cognitive appraisal	I have gotten in trouble for alcohol-related crimes.
Bothersome	I am bothered by legal problems my drinking has caused.
Influence on change	Legal problems make me think about changing my drinking.
Identity and Values Conflict	
Cognitive appraisal	When I drink, I'm not who I should be.
Cognitive appraisal	I don't like the person I am when I drink.
Cognitive appraisal	I don't recognize the person I am when I drink.
Cognitive appraisal	I have compromised my morals when drinking.
Cognitive appraisal	I have done things against my values while drinking.
Cognitive appraisal	I have done things I know are bad while drinking.
No cognitive appraisal	People have told me I change when I'm drinking.
No cognitive appraisal	People have told me I am a bad person when I'm drinking.
Bothersome	I am bothered by the person I am when drinking.
Influence on change	I think about changing my drinking because of how I feel about the person I become when drinking.
Spiritual Change	
No cognitive appraisal	I have recently experienced a spiritual change.
No cognitive appraisal	I have recently found the power of spirituality.
No cognitive appraisal	I have recently started going to church or other religious services.
No cognitive appraisal	I have recently changed my religious or spiritual beliefs.
Importance	Changes to my spirituality and/or religious beliefs are important to me.
Influence on change	Changes in my spirituality make me think about changing my drinking.
Cost-Benefit Analysis	
No cognitive appraisal	I've thought recently that my alcohol use is more bad than good.
Cognitive appraisal	I think my drinking causes more problems than it's worth.
No cognitive appraisal	I have been weighing the pros and cons of my drinking.
No cognitive appraisal	I have been thinking that my drinking has some advantages and some disadvantages.
Bothersome	Thinking of the pros and cons of my drinking bothers me.
Influence on change	Thinking of the pros and cons of my drinking makes me think about changing my drinking.
Loss of Control	
Cognitive appraisal	My life is out of control because of my drinking.
No cognitive appraisal	I have lost control over my drinking.
Cognitive appraisal	My drinking has made my life uncontrollable.
Cognitive appraisal	My problems are out of my control because of my drinking.
No cognitive appraisal	My life is out of control.

No cognitive appraisal	I have no control over things.
Bothersome	Losing control of things bothers me.
Influence on change	Losing control of things makes me think about changing my drinking.
Traumatic "Key Events"	
No cognitive appraisal	A bad thing happened that made me realize I need to change my drinking
No cognitive appraisal	Something bad happened that changed the way I see my drinking.
No cognitive appraisal	There is a clear moment I can think of that was so bad it made me seriously think about my drinking.
No cognitive appraisal	One bad event has made me think about reducing my drinking.
Bothersome	I am bothered by at least one bad event that has really impacted me.
Influence on change	At least one bad event has made me think about changing my drinking.
Positive "Key Events"	
No cognitive appraisal	Something good has happened that made me realize I should change my drinking.
No cognitive appraisal	A positive change in my life has changed the way I think about my drinking.
No cognitive appraisal	Something good has recently changed my life.
No cognitive appraisal	Something recently happened that was so good it has changed the way I see my drinking.
Importance	At least one good event has become important to me.
Influence on change	At least one good event has made me think about changing my drinking.
Motivation and Self-Efficacy	
Motivation	I really want to change my drinking.
Motivation	I have a lot of reasons to change my drinking.
Motivation	I feel ready to change my drinking.
Self-Efficacy	If I tried, I would be able to reduce my drinking.
Self-Efficacy	I can change my drinking for good.
Self-Efficacy	I would be able to reduce my drinking if I wanted to.
Motivation: importance	Being motivated to change my drinking is important to me.
Motivation: influence on change	Being motivated to change my drinking would help me think about changing my drinking.
Self-Efficacy: importance	Feeling confident that I could change my drinking is important to me.
Self-Efficacy: influence on change	Feeling confident that I could change my drinking would help me think about changing my drinking.

Table 6
Identified Experts for Study 2, Phase 1

Name	Example Relevant Publication Titles
Alyssa Forcehimes	De profundis: Spiritual transformations in Alcoholics Anonymous.
	Self-efficacy as a factor in abstinence from alcohol/other drug abuse: A meta-analysis.
Annika Jakobsson, Gunnel Hensing., & Fredrik Spak	The role of gendered conceptions in treatment seeking for alcohol problems.
	Developing a willingness to change: treatment-seeking processes for people with alcohol problems.
Arthur W. Blume	Motivating drinking behavior change--Depressive symptoms may not be noxious.
	Recent drinking consequences, motivation to change, and changes in alcohol consumption over a three month period.
William R. Miller	Why do people change addictive behavior?
Carlo DiClemente	Mechanisms, determinants and processes of change in the modification of drinking behavior.
Deborah S. Hasin	Does motivation to change mediate the effect of DSM-IV substance use disorders on treatment utilization and substance use?
	Treatment/self-help for alcohol-related problems: relationship to social pressure and alcohol dependence
Dennis Donovan	co-authored with many of the above researchers
Edna Oppenheimer	Outcome of alcoholism: the structure of patient attributions as to what causes change.
	Hearing the noise in the system. Exploration of textual analysis as a method for studying change in drinking behaviour.
Hans-Jurgen Rumpf	Several relevant publications
Harald Klingemann	Hitting rock bottom or the power of the positive: A dimensional analysis of natural recovery from alcohol and heroin abuse.
	The motivation to change from problem alcohol and heroin use.
Jalie A. Tucker	Predictors of help-seeking and the temporal relationship of help to recovery among treated and untreated recovered problem drinkers.
	Changing addictive behavior: Bridging clinical and public health strategies.

	Environmental contexts surrounding resolution of drinking problems among problem drinkers with different help-seeking experiences.
	Natural resolution of alcohol problems without treatment: Environmental contexts surrounding the initiation and maintenance of stable abstinence or moderation drinking.
James O. Prochaska	Predicting change in smoking status for self-changes.
	Subject characteristics as predictors of self-change in smoking.
John A. Cunningham	Exploring patterns of remission from alcohol dependence with and without Alcoholics Anonymous in a population sample.
	Assessing motivation for change: Preliminary development and evaluation of a scale measuring the costs and benefits of changing alcohol or drug use.
John Francis Kelly	Alcoholics Anonymous science update: Introduction to the special issue.
	How do people recovery from alcohol dependence? A systematic review of the research on mechanisms of behavior change in Alcoholics Anonymous.
	Mechanisms of behavior change in Alcoholics Anonymous: Does Alcoholics Anonymous lead to better alcohol use outcomes by reducing depression symptoms?
John W. Finney	Treatment and outcome for empirical subtypes of alcoholic patients.
	Entering treatment for alcohol abuse: a stress and coping model.
	The process of recovery from alcoholism: Comparing alcoholic patients and matched community controls.
Jon Morgenstern	Motivational interviewing: A pilot test of active ingredients and mechanisms of change.
Lance Brendan Young	Hitting bottom: Help seeking among Alcoholics Anonymous members. (2011)
Linda Sobell	What triggers the resolution of alcohol problems without treatment?
	2013 publication on rock-bottom
Mark Sobell	What triggers the resolution of alcohol problems without treatment?
Richard Longabaugh	Cognitive-behavioral treatment for alcohol dependence: a review of evidence for its hypothesized mechanisms of action.
Robert L. Stout	How do people recovery from alcohol dependence? A systematic review of the research on mechanisms of behavior change in

	Alcoholics Anonymous.
	Mechanisms of behavior change in Alcoholics Anonymous: Does Alcoholics Anonymous lead to better alcohol use outcomes by reducing depression symptoms?
Rudolf H. Moos	Treatment and outcome for empirical subtypes of alcoholic patients.
	Entering treatment for alcohol abuse: a stress and coping model.
	The process of recovery from alcoholism: Comparing alcoholic patients and matched community controls.
Ryan Kemp	Rock-bottom as an event of truth.
	Relating to the other: Truth and untruth in addiction.
Steve Maisto	Alcohol use disorder clinical course research: Informing clinicians' treatment planning now and in the future
Jennis Freyer-Adam	Intention to utilize formal help in a sample with alcohol problems: A prospective study
Ulrich John	Intention to utilize formal help in a sample with alcohol problems: A prospective study

Note. Not all experts listed provided feedback on the preliminary NADIR measure.

Table 7

114-Item NADIR measure administered during Study 2, Phase 2. Response options were 0 = False, 1 = Somewhat True, 2= Mostly True, 3= Definitely True.

Item		False	Some what true	Mostly true	Definitely true
1)	I fight with members of my family because of my drinking.	0	1	2	3
2)	Members of my family do not talk to me because of my drinking.[a]	0	1	2	3
3)	I have lost relationships with members of my family because of my drinking.	0	1	2	3
4)	My drinking has hurt my family.	0	1	2	3
5)	Members of my family tell me they dislike my drinking.	0	1	2	3
6)	Members of my family have told me my drinking negatively affects them.	0	1	2	3
7)	I am bothered by problems with members of my family caused by my drinking.	0	1	2	3
8)	Problems with members of my family make me think about changing my drinking.	0	1	2	3
9)	My drinking has made people pressure me to get help.	0	1	2	3
10)	As a result of my drinking, people have told me to go to treatment.	0	1	2	3
11)	People talk about me needing to go to treatment for my drinking.	0	1	2	3
12)	I know my drinking makes people want me to go to treatment.	0	1	2	3
13)	People say I need help with my drinking.	0	1	2	3
14)	People pressure me to reduce my drinking.	0	1	2	3
15)	I am bothered by problems I have with other people regarding my drinking.	0	1	2	3
16)	Problems I have with people make me think about changing my drinking.	0	1	2	3
17)	My friends and loved ones are supportive of me getting help with my drinking. [a]	0	1	2	3
18)	My friends and loved ones would support me if I got help with my drinking. [a]	0	1	2	3
19)	My friends and loved ones are available and willing to help me reduce my drinking. [a]	0	1	2	3
20)	My friends and loved ones are supportive of me changing my drinking. [a]	0	1	2	3
21)	Support from my friends and loved ones is important to me. [a]	0	1	2	3
22)	Support from my friends and loved ones makes me think about changing my drinking. [a]	0	1	2	3
23)	I know my drinking is making me sick.	0	1	2	3
24)	My health has suffered because of my drinking.	0	1	2	3
25)	My drinking has made me less healthy than I should be. [a]	0	1	2	3
26)	My drinking is killing me. [a]	0	1	2	3

27)	I've been told drinking is bad for my health. [a]	0	1	2	3
28)	A medical professional has told me my drinking is unhealthy for me. [a]	0	1	2	3
29)	My health problems related to my drinking bother me. [a]	0	1	2	3
30)	My health problems make me think about changing my drinking. [a]	0	1	2	3
31)	Because of my drinking, I feel sad more often than not.	0	1	2	3
32)	My mental health has suffered because of my drinking.	0	1	2	3
33)	Because of my drinking, I struggle to control my emotions.	0	1	2	3
34)	My drinking makes me feel mentally ill.	0	1	2	3
35)	People have told me that drinking negatively affects my mood.	0	1	2	3
36)	People have told me that drinking negatively affects my mental health. [a]	0	1	2	3
37)	My emotional/mental health problems related to my drinking bother me.	0	1	2	3
38)	My emotional/mental health problems make me think about changing my drinking.	0	1	2	3
39)	My work has suffered because of my drinking.	0	1	2	3
40)	My drinking has caused problems with my job.	0	1	2	3
41)	I have problems at work because of my drinking.	0	1	2	3
42)	I have a lot of debt because of my drinking.	0	1	2	3
43)	I have problems with money related to my drinking.	0	1	2	3
44)	I spend too much money because of my drinking. [a]	0	1	2	3
45)	I have problems with housing because of my drinking.	0	1	2	3
46)	My drinking has caused difficulty in keeping stable housing.	0	1	2	3
47)	I am bothered by problems with my job caused by my drinking.	0	1	2	3
48)	I am bothered by problems with money caused by my drinking.	0	1	2	3
49)	I am bothered by problems with housing caused by my drinking.	0	1	2	3
50)	Problems with my job make me think about changing my drinking.	0	1	2	3
51)	Problems with money make me think about changing my drinking.	0	1	2	3
52)	Problems with housing make me think about changing my drinking.	0	1	2	3
53)	I have been arrested because of my drinking.	0	1	2	3
54)	I have had problems with the law because of my drinking.	0	1	2	3
55)	My drinking has caused me to engage in illegal behavior. [a]	0	1	2	3
56)	I have gotten in trouble for alcohol-related crimes.	0	1	2	3
57)	I am bothered by legal problems my drinking has caused.	0	1	2	3
58)	Legal problems make me think about changing my	0	1	2	3

	drinking. [a]				
59)	When I drink, I'm not who I should be.	0	1	2	3
60)	I don't like the person I am when I drink.	0	1	2	3
61)	I don't recognize the person I am when I drink.	0	1	2	3
62)	I have compromised my morals when drinking. [a]	0	1	2	3
63)	I have done things against my values (e.g., things I regret) while drinking. [a]	0	1	2	3
64)	I have done things I know are bad while drinking. [a]	0	1	2	3
65)	People have told me I change when I'm drinking. [a]	0	1	2	3
66)	People have told me I am a bad person when I'm drinking.	0	1	2	3
67)	I am bothered by the person I am when drinking.	0	1	2	3
68)	I think about changing my drinking because of how I feel about the person I become when drinking.	0	1	2	3
69)	I have recently experienced spiritual emptiness. [a]	0	1	2	3
70)	I have recently found the power of spirituality. [a]	0	1	2	3
71)	I have recently started going to church or other religious services. [a]	0	1	2	3
72)	I have recently changed my religious or spiritual beliefs. [a]	0	1	2	3
73)	Changes to my spirituality and/or religious beliefs are important to me. [a]	0	1	2	3
74)	Changes in my spirituality make me think about changing my drinking. [a]	0	1	2	3
75)	I've thought recently that my alcohol use is more bad than good. [a]	0	1	2	3
76)	I think my drinking causes more problems than it's worth.	0	1	2	3
77)	I have been weighing the pros and cons of my drinking. [a]	0	1	2	3
78)	I have been thinking that my drinking has some advantages and some disadvantages. [a]	0	1	2	3
79)	Thinking of the pros and cons of my drinking bothers me. [a]	0	1	2	3
80)	Thinking of the pros and cons of my drinking makes me think about changing my drinking. [a]	0	1	2	3
81)	My life is out of control because of my drinking.	0	1	2	3
82)	I have lost control over my drinking.	0	1	2	3
83)	My drinking has made my life uncontrollable.	0	1	2	3
84)	My problems are out of my control because of my drinking.	0	1	2	3
85)	My life is out of control. [a]	0	1	2	3
86)	I have no control over things. [a]	0	1	2	3
87)	Losing control of things bothers me. [a]	0	1	2	3
88)	Losing control of things makes me think about changing my drinking.	0	1	2	3
89)	A bad thing happened that made me realize I need to change my drinking.	0	1	2	3
90)	Something bad happened that changed the way I see my drinking.	0	1	2	3

91)	There is a clear moment I can think of that was so bad it made me seriously think about my drinking.	0	1	2	3
92)	One bad event has made me think about reducing my drinking.	0	1	2	3
93)	I am bothered by at least one bad event that has really impacted me. [a]	0	1	2	3
94)	At least one bad event has made me think about changing my drinking.	0	1	2	3
95)	Something good has happened that made me realize I should change my drinking. [a]	0	1	2	3
96)	A positive change in my life has changed the way I think about my drinking. [a]	0	1	2	3
97)	Something good has recently changed my life. [a]	0	1	2	3
98)	Something recently happened that was so good it has changed the way I see my drinking. [a]	0	1	2	3
99)	At least one good event has become important to me. [a]	0	1	2	3
100)	At least one good event has made me think about changing my drinking. [a]	0	1	2	3
101)	I really want to change my drinking.	0	1	2	3
102)	I have a lot of reasons to change my drinking.	0	1	2	3
103)	I feel ready to change my drinking. [a]	0	1	2	3
104)	If I tried, I would be able to reduce my drinking. [a]	0	1	2	3
105)	I can change my drinking for good. [a]	0	1	2	3
106)	I would be able to reduce my drinking if I wanted to. [a]	0	1	2	3
107)	Being motivated to change my drinking is important to me. [a]	0	1	2	3
108)	Being motivated to change my drinking would help me think about changing my drinking. [a]	0	1	2	3
109)	Feeling confident that I could change my drinking is important to me. [a]	0	1	2	3
110)	Feeling confident that I could change my drinking would help me think about changing my drinking. [a]	0	1	2	3
111)	New role obligations interfere with my drinking. [a]	0	1	2	3
112)	Drinking no longer fits in my life. [a]	0	1	2	3
113)	A challenge in my life makes it necessary to change my drinking. [a]	0	1	2	3
114)	Things in my life are not the same now, so I am forced to change my drinking. [a]	0	1	2	3

Note. Instructions to participants are: "Please indicate how true you feel each of the following statements is for you right now."

[a] Indicates this item was removed from IRT-driven factor analyses.

Table 8

Overall Participant Descriptives for Study 2, Phase 2 (N = 402)

Variable	Descriptive statistic	M (SD) or N (%)	Minimum-Maximum
Age		31.6 (10.2)	
Gender			
	Male	209.0 (52.6%)	
	Female	185.0 (46.6%)	
	Transgender	3.0 (0.8%)	
Race			
	American Indian or Alaska Native	12.0 (3.0%)	
	Asian	16.0 (4.1%)	
	Black or African American	37.0 (9.4%)	
	White or Caucasian	278.0 (70.4%)	
	Other	22.0 (5.6%)	
	Multi-Racial	30.0 (7.6%)	
Ethnicity (Hispanic)		93.0 (24.6%)	
Typical # of drinks per week		29.8 (22.1)	3.0-140.0
Typical # of drinking days per week		5.0 (2.04)	0.0-7.0
Peak # of drinks per week		40.8 (30.8)	2.0-210.0
Peak # of drinking days per week		5.1 (2.19)	0.0-7.0
DDD: typical week		5.5 (3.72)	1.0-30.0
DDD: peak week		7.1 (4.7)	1.0-34.0
SIP summary score		7.6 (4.4)	
AUDIT summary score		16.3 (8.3)	

Table 9

Participant Descriptives for Study 2, Phase 2 by Recruitment Site

Variable	Descriptive statistic	Albuquerque (n = 97) M (SD) or N (%)	MTURK (n = 196) M (SD) or N (%)	Nationwide (n = 109) M (SD) or N (%)
Age		32.3 (11.4)	30.8 (8.7)	32.6 (11.5)
Gender				
	Male	41.0 (43.2%)	118.0 (59.5%)	52.0 (48.6%)
	Female	55.0 (54.7%)	78.0 (40.5%)	54.0 (5035%)
	Transgender	1.0 (2.1%)	0.0 (0%)	1.0 (0.9%)
Race				
	American Indian or Alaska Native	6.0 (6.5%)	5.0 (2.6%)	1.0 (0.9%)
	Asian	0.0 (0%)	13.0 (6.6%)	3.0 (2.8%)
	Black or African American	3.0 (3.3%)	10.0 (5.1%)	24.0 (22.4%)
	White or Caucasian	57.0 (62.0%)	154.0 (78.6%)	67.0 (62.6%)
	Other	12.0 (13.0%)	2.0 (1.0%)	8.0 (7.5%)
	Multi-Racial	14.0 (15.2%)	12.0 (6.1%)	4.0 (3.7%)
Ethnicity (Hispanic)		47.0 (49.0%)	27.0 (14.0%)	19.0 (17.8%)
Typical # of drinks per week		37.3 (25.9)*[a]	27.4 (19.9) *[a]	28.6 (21.7) *[a]
Minimum-Maximum typical # of drinks per week		4.0-120.0	3.0-100.0	3.0-140.0

Typical # of drinking days per week	5.0 (2.2)	5.0 (2.0)	5.2 (2.0)
Minimum-Maximum typical # of drinking days per week	0.0-7.0	0.0-7.0	0.0-7.0
Peak # of drinks per week	50.8 (39.9) *[a]	38.2 (28.4) *[a]	38.8 (26.8) *[a]
Minimum-Maximum peak # of drinks per week	4.0-210.0	3.0-148.0	2.0-140.0
Peak # of drinking days per week	4.4 (2.6) *[a]	5.3 (2.0) *[a]	5.3 (2.1) *[a]
Minimum-Maximum peak # of drinking days per week	0.0-7.0	0.0-7.0	0.0-7.0
DDD: typical week	6.2 (3.8)	5.5 (3.9)	5.3 (3.4)
Minimum-Maximum DDD: typical week	1.6-18.3	1.3-30.0	1.0-20.0
DDD: peak week	8.3 (5.4)	6.9 (4.7)	6.5 (3.9)
Minimum-Maximum DDD: peak week	1.4-30.0	1.3-34.0	1.0-20.0

SIP summary score	9.0 (4.4)*	7.0 (4.2)*	7.3 (4.6)*
AUDIT summary score	17.8 (8.5)	15.3 (7.7)	16.6 (9.0)
Prior lifetime treatment	41 (46.6%)	61 (33.2%)	38 (40.4%)

Note. Significant one-way ANOVA differences in typical # of drinks in typical and peak weeks, typical # of drinking days in typical and peak weeks, SIP, AUDIT in are indicated by *. Results with corresponding significant Level Statistic p-values are indicated by [a]

Table 10

Exploratory Factor Analysis Eigenvalues for Sample Correlation Matrix for Study 2, Phase 2

Factor	Eigenvalue
1	59.898
2	7.563
3	4.687
4	4.111
5	3.501
6	2.642
7	2.54
8	2.335
9	2.021
10	1.764
11	1.674
12	1.415
13	1.296
14	1.184
15	1.132
16	0.927
17	0.886
18	0.822
19	0.785
20	0.766

Table 11

Final 60-Item NADIR Measure Used in Final CFA Model, with Factor Loadings

Item	Social network	Health problems	Situation/ Environ.	Existential issues	Cognitive appraisal	Importance/ Influence
1) I fight with members of my family because of my drinking.	0.747				0.191	
2) I have lost relationships with members of my family because of my drinking.	0.732				0.195	
3) My drinking has hurt my family.	0.796				0.162	
4) Members of my family tell me they dislike my drinking.	0.886					
5) Members of my family have told me my drinking negatively affects them.	0.929					
6) I am bothered by problems with members of my family caused by my drinking.	0.836					0.105
7) Problems with members of my family make me think about changing my drinking.	0.687					0.237
8) My drinking has made people pressure me to get help.	0.891				0.069	
9) As a result of my drinking, people have told me to go to treatment.	0.964					
10) People talk about me needing to go to treatment for my drinking.	0.984					
11) I know my drinking makes people want me to go to treatment.	0.889				0.094	
12) People say I need help with my drinking.	0.955					
13) People pressure me to reduce my drinking.	0.890					
14) I am bothered by problems I have with other people regarding my drinking.	0.746					0.220

15) Problems I have with people make me think about changing my drinking.	0.652			0.320
16) I know my drinking is making me sick.		0.894		
17) My health has suffered because of my drinking.		0.858		
18) Because of my drinking, I feel sad more often than not.		0.907		
19) My mental health has suffered because of my drinking.		0.913		
20) Because of my drinking, I struggle to control my emotions.		0.904		
21) My drinking makes me feel mentally ill.		0.911		
22) People have told me that drinking negatively affects my mood.		0.897		
23) My emotional/mental health problems related to my drinking bother me.		0.925		
24) My emotional/mental health problems make me think about changing my drinking.		0.920		
25) My work has suffered because of my drinking.			0.562	0.509
26) My drinking has caused problems with my job.			0.622	0.504
27) I have problems at work because of my drinking.			0.619	0.498
28) I have a lot of debt because of my drinking.			0.526	0.552
29) I have problems with money related to my drinking.			0.536	0.521
30) I have problems with housing because of my drinking.			0.555	0.587
31) My drinking has caused difficulty in keeping			0.533	0.614

stable housing.			
32) I am bothered by problems with my job caused by my drinking.	0.501		0.618
33) I am bothered by problems with money caused by my drinking.	0.386		0.674
34) I am bothered by problems with housing caused by my drinking.	0.466		0.670
35) Problems with my job make me think about changing my drinking.	0.410		0.692
36) Problems with money make me think about changing my drinking.	0.305		0.693
37) Problems with housing make me think about changing my drinking.	0.436		0.694
38) I have been arrested because of my drinking.	0.983		
39) I have had problems with the law because of my drinking.	0.971		
40) I have gotten in trouble for alcohol-related crimes.	0.966		
41) I am bothered by legal problems my drinking has caused.	0.821		0.173
42) When I drink, I'm not who I should be.		0.898	
43) I don't like the person I am when I drink.		0.918	
44) I don't recognize the person I am when I drink.		0.907	
45) People have told me I am a bad person when I'm drinking.		0.957	
46) I am bothered by the person I am when drinking.		0.959	
47) I think about changing my drinking because of how I feel about the person I become when		0.938	

drinking.		
48) I think my drinking causes more problems than it's worth.	0.848	
49) My life is out of control because of my drinking.	0.974	
50) I have lost control over my drinking.	0.927	
51) My drinking has made my life uncontrollable.	0.978	
52) My problems are out of my control because of my drinking.	0.992	
53) Losing control of things makes me think about changing my drinking.	-0.068	1.004
54) A bad thing happened that made me realize I need to change my drinking.	0.930	
55) Something bad happened that changed the way I see my drinking.	0.939	
56) There is a clear moment I can think of that was so bad it made me seriously think about my drinking.	0.904	
57) One bad event has made me think about reducing my drinking.	0.896	
58) At least one bad event has made me think about changing my drinking.	0.870	
59) I really want to change my drinking.	0.842	
60) I have a lot of reasons to change my drinking.	0.858	

Table 12
Removed NADIR Items

Item
Members of my family do not talk to me because of my drinking.
My friends and loved ones are supportive of me getting help with my drinking.
My friends and loved ones would support me if I got help with my drinking.
My friends and loved ones are available and willing to help me reduce my drinking.
My friends and loved ones are supportive of me changing my drinking.
Support from my friends and loved ones is important to me.
Support from my friends and loved ones makes me think about changing my drinking.
My drinking has made me less healthy than I should be.
My drinking is killing me.
I've been told drinking is bad for my health.
A medical professional has told me my drinking is unhealthy for me.
My health problems related to my drinking bother me.
My health problems make me think about changing my drinking.
People have told me that drinking negatively affects my mental health.
I spend too much money because of my drinking.
My drinking has caused me to engage in illegal behavior.
Legal problems make me think about changing my drinking.
I have compromised my morals when drinking.
I have done things against my values (e.g., things I regret) while drinking.
I have done things I know are bad while drinking.
People have told me I change when I'm drinking.
I have recently experienced spiritual emptiness.
I have recently found the power of spirituality.
I have recently started going to church or other religious services.
I have recently changed my religious or spiritual beliefs.
Changes to my spirituality and/or religious beliefs are important to me.
Changes in my spirituality make me think about changing my drinking.
I've thought recently that my alcohol use is more bad than good.
I have been weighing the pros and cons of my drinking.
I have been thinking that my drinking has some advantages and some disadvantages.
Thinking of the pros and cons of my drinking bothers me.
Thinking of the pros and cons of my drinking makes me think about changing my drinking.
My life is out of control.
I have no control over things.
Losing control of things bothers me.
I am bothered by at least one bad event that has really impacted me.
Something good has happened that made me realize I should change my drinking.
A positive change in my life has changed the way I think about my drinking.
Something good has recently changed my life.

Something recently happened that was so good it has changed the way I see my drinking.
At least one good event has become important to me.
At least one good event has made me think about changing my drinking.
I feel ready to change my drinking.
If I tried, I would be able to reduce my drinking.
I can change my drinking for good.
I would be able to reduce my drinking if I wanted to.
Being motivated to change my drinking is important to me.
Being motivated to change my drinking would help me think about changing my drinking.
Feeling confident that I could change my drinking is important to me.
Feeling confident that I could change my drinking would help me think about changing my drinking.
New role obligations interfere with my drinking.
Drinking no longer fits in my life.
A challenge in my life makes it necessary to change my drinking.
Things in my life are not the same now, so I am forced to change my drinking.

Table 13

Internal Consistency Reliability of 60-Item NADIR Measure

Item	α if item deleted
I fight with members of my family because of my drinking.	0.985
I have lost relationships with members of my family because of my drinking.	0.985
My drinking has hurt my family.	0.984
Members of my family tell me they dislike my drinking.	0.985
Members of my family have told me my drinking negatively affects them.	0.985
I am bothered by problems with members of my family caused by my drinking.	0.985
Problems with members of my family make me think about changing my drinking.	0.985
My drinking has made people pressure me to get help.	0.984
As a result of my drinking, people have told me to go to treatment.	0.984
People talk about me needing to go to treatment for my drinking.	0.985
I know my drinking makes people want me to go to treatment.	0.984
People say I need help with my drinking.	0.985
People pressure me to reduce my drinking.	0.985
I am bothered by problems I have with other people regarding my drinking.	0.984
Problems I have with people make me think about changing my drinking.	0.985
I know my drinking is making me sick.	0.985
My health has suffered because of my drinking.	0.985
Because of my drinking, I feel sad more often than not.	0.985
My mental health has suffered because of my drinking.	0.985
Because of my drinking, I struggle to control my emotions.	0.985
My drinking makes me feel mentally ill.	0.985
People have told me that drinking negatively affects my mood.	0.985
My emotional/mental health problems related to my drinking bother me.	0.985
My emotional/mental health problems make me think about changing my drinking.	0.985
My work has suffered because of my drinking.	0.985
My drinking has caused problems with my job.	0.985
I have problems at work because of my drinking.	0.985
I have a lot of debt because of my drinking.	0.985
I have problems with money related to my drinking.	0.985
I have problems with housing because of my drinking.	0.985
My drinking has caused difficulty in keeping stable housing.	0.985
I am bothered by problems with my job caused by my drinking.	0.985
I am bothered by problems with money caused by my drinking.	0.985
I am bothered by problems with housing caused by my drinking.	0.985
Problems with my job make me think about changing my drinking.	0.985

Problems with money make me think about changing my drinking.	0.985
Problems with housing make me think about changing my drinking.	0.985
I have been arrested because of my drinking.	0.985
I have had problems with the law because of my drinking.	0.985
I have gotten in trouble for alcohol-related crimes.	0.985
I am bothered by legal problems my drinking has caused.	0.985
When I drink, I'm not who I should be.	0.985
I don't like the person I am when I drink.	0.985
I don't recognize the person I am when I drink.	0.985
People have told me I am a bad person when I'm drinking.	0.985
I am bothered by the person I am when drinking.	0.985
I think about changing my drinking because of how I feel about the person I become when drinking.	0.985
I think my drinking causes more problems than it's worth.	0.985
My life is out of control because of my drinking.	0.984
I have lost control over my drinking.	0.985
My drinking has made my life uncontrollable.	0.984
My problems are out of my control because of my drinking.	0.984
Losing control of things makes me think about changing my drinking.	0.985
A bad thing happened that made me realize I need to change my drinking.	0.985
Something bad happened that changed the way I see my drinking.	0.985
There is a clear moment I can think of that was so bad it made me seriously think about my drinking.	0.985
One bad event has made me think about reducing my drinking.	0.985
At least one bad event has made me think about changing my drinking.	0.985
I really want to change my drinking.	0.985
I have a lot of reasons to change my drinking.	0.985

Table 14

Correlations between Factors and Drinking Variables

	Social network factor	Health problem factor	Situation/ Environment factor	Existential issues factor	Cognitive appraisal factor	Importance/ Influence factor
SIP	.729**	.727**	.638**	.697**	.742**	.711**
AUDIT	.756**	.767**	.612**	.701**	.781**	.744**
Total # of drinking days: typical week	.258**	.250**	.205**	.192**	.260**	.263**
Total # of drinking days: peak week	.165**	.164**	.109*	.161**	.215**	.243**
Total drinks per typical week	.437**	.386**	.391**	.348**	.431**	.398**
Total drinks per peak week	.373**	.312**	.377**	.278**	.337**	.298**
Average per drinking day: typical week	.333**	.272**	.289**	.246**	.321**	.263**
Average drinks per drinking day: peak week	.303**	.231**	.337**	.202**	.247**	.189**

Note. ** $p < .01$; * $p < .05$; SIP = Short Inventory of Problems; AUDIT = Alcohol Use Disorder Identification Test

Table 15

Correlations between Factors

	Social network factor	Health problem factor	Situation/ Environment factor	Existential issues factor	Cognitive appraisal factor	Importance/ Influence factor
Social network factor						
Health problem factor	0.804					
Situation/Environment factor	0.571	0.505				
Existential issues factor	0.771	0.804	0.480			
Cognitive appraisal factor	0.746	0.804	0.448	0.790		
Importance/Influence factor	0.729	0.797	0.411	0.823	0.881	

Table 16

Differences by gender and treatment history

Means (SD)	Social network factor	Health problem factor	Situation/ Environment factor	Existential issues factor	Cognitive appraisal factor	Importance/ Influence factor
Males	0.01 (0.66)	-0.07 (0.76)*	0.09 (0.41)	-0.01 (0.79)*	-0.01 (0.75)*	-0.00 (0.09)*
Females	0.11 (0.62)	0.20 (0.76)*	0.04 (0.39)	0.14 (0.73)*	0.16 (0.72)*	0.02 (0.09)*
No treatment history	-0.15 (0.54)*	-0.16 (0.68)*	-0.04 (0.35)*	-0.15 (0.69)*	-0.13 (0.70)*	-0.01 (0.08)*
Treatment History	0.46 (0.63)*	0.48 (0.79)*	0.28 (0.41)*	0.47 (0.77)*	0.42 (0.71)*	0.05 (0.09)*

Note. * indicates $p < .05$