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The effects of drinkers' concerned significant others on alcohol cue reactivity

Benjamin Olson Ladd

Benjamin Ladd
Candidate

Psychology
Department

This thesis is approved, and it is acceptable in quality and form for publication:

Approved by the Thesis Committee:

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The Effects of Drinkers' Concerned Significant Others on Alcohol Cue Reactivity

BY

Benjamin Olson Ladd

B.S., Psychology, Brown University 2006

THESIS

Submitted in Partial Fulfillment of the
Requirements for the Degree of

Master of Science
Psychology

The University of New Mexico
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May, 2010

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ABSTRACT OF THESIS

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Abstract

Alcohol use disorders (AUDs) are pervasive in society and notoriously difficult to treat successfully. Incorporation of a member of the social network into the therapeutic framework for treating AUDs has been found to improve treatment outcomes compared to individual-focused treatments. The goal of this study was to examine the effects of concerned significant others (CSO) on drinkers' neural response to alcohol cues. A sample of social to heavy drinkers (n = 16) completed a functional magnetic resonance imaging (fMRI) scan. During the scan, participants completed an alcohol cue reactivity task twice; one time by themselves, and another time while holding the hand of their CSO. Both participants and their CSOs completed a brief battery of psychological questionnaires. Results showed minimal neural activation in response to the cue reactivity paradigm. The interaction of hand condition by alcohol cue reactivity showed some significant activation in the areas of the medial prefrontal cortex, an area implicated in alcohol use disorders and evaluation of reward. This pattern of activation appeared to be moderated by CSO level of drinking, CSO support for abstinence, and relationship satisfaction. Possible reasons for the failure to detect a significant effect of alcohol cues on neural response are discussed. The implications of the current study, as well as potential future directions also are addressed.

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Alcohol use disorders are pervasive in society and notoriously difficult to treat successfully. Incorporation of a spouse or concerned significant other (CSO) into the therapeutic framework for treating alcohol use disorders (AUDs) has been found to improve treatment outcomes compared to individual-focused treatments. While these improvements often have been found to be quite significant and robust, there is a paucity of research on the exact mechanisms by which an alcoholic's CSO increases that individual's ability to stop drinking and have a better post-treatment trajectory. Research from other areas of inquiry has shown that the presence of a CSO has attenuating effects on neural response in participants. This study aimed to extend that literature to the alcohol field while also investigating possible beneficial mechanisms of a CSO by examining if the presence of a CSO affects alcohol craving.

The concept of craving has long been considered an important component of alcohol use and physiological dependence. Craving commonly has been defined as the urge to drink, or "the force driving individuals down the path toward alcohol consumption" (Breiner, Stritzke, & Lang, 1999, pg. 205). The concept of craving assumes underlying motivating processes driving alcohol consumption and often is invoked to explain relapse. According to models promoting this theoretical perspective, craving should be strongly associated with relapse. However, findings regarding craving for alcohol and clinical outcomes have been mixed (see Ooteman, Koeter, Vserheul, Schippers, & van den Brink, 2006; Rohsenow & Monti, 1999). The term craving is used in many different ways in alcohol research. One study may have an operational definition of craving entirely distinct from another, and a third may not even provide a working description of alcohol craving (Drummond, 2001). Thus, this plethora of operational models leads to many definitions of craving, which may explain the inconsistent findings and intense controversy surrounding the construct of alcohol craving.

One operational definition of craving that has received considerable attention is cue reactivity. At the most basic level, cue reactivity is simply an individual's response to alcohol cues. Most cue reactivity models are based on a classical conditioning framework, where certain cues become associated with subsequent alcohol use. These unconditioned stimuli become conditioned cues that elicit specific responses, including craving for alcohol. Craving is seen as an integral part of the addiction process, and is commonly invoked to explain the mechanisms behind relapse (Monti, Rohsenow, & Hutchison, 2000). The advantage of using cue reactivity paradigms to study craving and alcohol relapse is that cue reactivity can be well defined and is directly testable and observable within an experimental paradigm.

Recently, neuroimaging techniques have been found to be especially effective for measuring individuals' responses to alcohol (i.e. cue reactivity) under a variety of stimulus sets. Alcohol-associated visual stimuli reliably evoke differential brain activation in alcoholic individuals (Myrick et al., 2004; Wrase et al., 2002; Wrase et al., 2007). Olfactory alcohol cues also have been shown to significantly affect neural activation in alcoholics (Schneider et al., 2001). Within the laboratory setting, allowing a participant to actually consume alcohol has been one of the most salient and successful ways to evoke alcohol cue-reactivity (Litt & Cooney, 1999). Thus, taste paradigms have been introduced into neuroimaging studies of cue response (George et al., 2001). As the current study was quite exploratory in nature, taste cues were used to maximize the potential for observable effects within the cue exposure manipulation.

Not only have neural activation techniques been effective for measuring alcohol cue reactivity, but the regions implicated in such responses also are areas expected to be involved in alcohol-related cues from a theoretical perspective. According to the classical conditioning framework, cues can elicit an alcohol response through two distinct pathways: positive reinforcement and negative reinforcement (Rock & Kambouropoulos, 2007). In negative reinforcement, cues evoke withdrawal-like symptoms, which subsequent alcohol use serves to alleviate. Through positive reinforcement, the response to cues is drug-like, leading to an appetitive drive to drink to achieve the rewarding effects of alcohol. The current state of evidence favors a positive reinforcement model (Rock & Kambouropoulos, 2007). As such, neural regions associated with reward are expected to be activated in cue reactivity paradigms. The mesolimbic dopaminergic system, including the striatum, anterior cingulate cortex (ACC), and medial prefrontal cortex (mPFC), is associated with salience of rewarding systems. Increased activation of the ventral striatum has been associated with increased craving upon presentation of alcohol cues (Wrase et al., 2007). Activation of the ACC, mPFC, and striatum also has been shown to be associated with alcohol cues (Boggio et al., 2008; Heinz et al., 2004; Sinha & Li, 2007). Additionally, activation of these regions was more pronounced in individuals who went on to relapse (Grusser et al., 2004). These results indicate the potential clinical applicability and utility of such experimental paradigms.

Recently, neuroimaging techniques have been found to be especially effective at measuring individuals' responses to alcohol under a variety of stimulus sets. Alcohol-associated visual stimuli reliably evoke differential brain activation in alcoholic individuals (Myrick et al., 2004; Wrase et al., 2002; Wrase et al., 2007). Olfactory alcohol cues also have been shown to significantly affect neural activation in alcoholics (Schneider et al., 2001). Within the laboratory setting, allowing a participant to actually consume alcohol has been one of the most salient and successful ways to evoke alcohol cue reactivity (Litt & Cooney, 1999). Thus, taste paradigms have been introduced into neuroimaging studies of cue response (George et al., 2001).

Although cue reactivity has been evoked reliably in the laboratory, these measurements seem to have little ecological validity. In fact, response to alcoholic beverage cues has been inconsistent in predicting alcohol use outcome (Monti, Rohsenow, & Hutchison, 2000), perhaps due to the contrived environment of the lab. Self-report urges and ability to refrain from drinking as assessed in the lab may mean little once the person is back in their natural environment. Therefore, considering cue reactivity in contexts that are present in drinkers' natural environments is very important and may contribute to researchers' understanding of the influence of such responses. Incorporating naturally occurring contexts into experimental paradigms also may increase the predictive utility of cue reactivity by giving such assessments stronger ecological validity.

The strong influence of context on cue reactivity also has implications for clinical work. Cue exposure therapy (CET) has been shown to be efficacious in treating problematic alcohol users, but no definitive approach has yet been identified (Stasiewicz, Brandon, & Bradizza, 2007). This lack of knowledge of a single reliable CET method is due at least in part to the fact that following cue extinction in the treatment setting, an individual is then confronted with cues in the environment that are entirely different, increasing the likelihood of renewal of the conditioned response, i.e. drinking. Some researchers have pointed to the effect of cognitive factors on reactivity to alcohol cues, noting their importance when considering response to alcohol (Bradizza, Stasiewicz, & Maisto, 1994). For example, MacKillop & Lisman (2005) showed that the context of perceived availability affects urge to drink. In this study, when exposed to alcohol cues, heavy-drinking college students who were told they would not be permitted to drink reported significantly higher urges to drink than those told they would be allowed to drink. Another study examined cue response renewal while manipulating the context to be the same or different from the context where extinction trials were completed (Collins & Brandon, 2002). This study had a similar population of college students, although moderate drinkers also were included. All participants completed extinction trials while being exposed to alcohol cues. After a distraction period, participants again were exposed to the same alcohol cues, but in either the room where the extinction trials were run (same context) or a different room (different context). Renewal of cue reactivity, as measured by salivary response, was greater in different contexts, suggesting that cue exposure does not generalize across contexts. In nonclinical research, environmental contexts were observed to trigger relapse in rats, but this effect was reduced in rats whose response was extinguished over multiple contexts (Chaudri, Sahuque, & Janak, 2008).

Context is clearly very important when considering response to alcohol, and these findings have significant implications for clinical work and intervention. By examining various contexts that are significant in precipitating or preventing alcohol use, clinicians can be better informed about what may be particularly helpful to an individual. One such context that is strongly associated with and influential in problematic drinking behavior is that of the social network of drinkers. Social factors are important to consider when looking at an individual's drinking behavior and, in some cases, may be equally as or more influential than biological and intrapersonal factors. There are many findings that point to the significant influence of social networks on an individual's drinking (Beattie & Longabaugh, 1999; Litt, Kadden, Kabel-Cormier, & Petry, 2007; McCrady, 2004). However, the most consistent feature of research on social support and drinking is the inconsistent effects that this factor has on drinking behavior (Beattie & Longabaugh, 1997; McCrady, 2004).

In an attempt to explain the wide range of findings on network support and drinking outcomes, Beattie & Longabaugh (1999) parsed network support into two components: general support and alcohol-specific support. In this report, the authors drew from data collected in a study comparing three different outpatient treatment approaches, all based in a social learning framework. Participants were diagnosed with alcohol dependence (78%) or alcohol abuse. Analyses showed that not only did general social support and support for abstinence contribute unique variance in explaining percent days abstinent (PDA) at six months, but that only support for abstinence continued to do so over the longer term. Additionally, alcohol-specific support was found to be a stronger predictor of PDA than general support. Thus, it seems that the general construct of network support may not be as significant as more specific facets of social support when considering drinking behavior. Litt et al. (2007) addressed the importance of alcohol specific support by using an intervention specifically designed to change drinkers' network support (NS) to be more supportive of abstinence. In this study, participants meeting diagnostic criteria for an alcohol use disorder (99% alcohol dependent) were randomly assigned to the network support treatment, a case management (CaseM) control treatment, or a NS + CaseM treatment. Results showed no difference between the two conditions involving NS: collapsing across the NS conditions showed the NS group had significantly higher PDA during follow-up compared to the group receiving only CaseM. The NS group also had increased support for abstinence while the CaseM group did not. Interestingly, the NS group did not have a decrease in social support for drinking compared to controls. While previous findings have shown that networks supportive of drinking predict poorer outcomes (Longabaugh, Wirtz, Zweben, & Stout, 1998), the findings of Litt et al. suggest that support for abstinence may override the negative influence of support for drinking.

Another domain where social support has been examined more deeply is the structure of drinkers' social support. One study examined the influence of drinking and nondrinking friends on an individual's drinking behavior in the Project MATCH sample (Mohr, Averna, Kenny, & Del Boca, 2001). The findings showed that an increase in the proportion of nondrinking friends in a drinker's network was associated with lower post-treatment drinks per drinking day, while increased importance of nondrinking friends was associated with higher PDA. Beattie & Longabaugh (1997) found that in a sample of participants meeting DSM-III criteria for alcohol use disorder (79% alcohol dependent) both friend and family support for abstinence were correlated significantly with post-treatment PDA, such that greater support was associated with higher PDA. Only family support for abstinence was found to be significantly correlated with percent days of heavy drinking (PDH), where more familial support led to lower PDH.

The spouse or significant other (SO) has been singled out as important in alcohol use outcomes. A drinker's SO is both important and influential on their drinking behavior, as the SO fits into both friend and family categories, as well as the role of intimate partner. In fact, simply having a spouse is associated with positive treatment outcome (Havassy, Hall, & Wasserman, 1991). For male participants diagnosed with an AUD in a long-term stable relationship, having an SO with an alcohol problem is negatively predictive of recovery from an AUD, while having an SO with a strong social network predicts better outcomes (McAweeney, Zucker, Fitzgerald, Puttler, & Wong, 2005). It was hypothesized that the social supports of the SO may serve as a buffer for their partner's drinking. Men diagnosed with a substance use disorder (SUD) with an SO also present with a more favorable clinical profile - in one study they were more likely to be employed, had fewer psychological symptoms, fewer weeks of previous inpatient SUD treatment, and lower frequencies of use (Tracy, Kelly, & Moos, 2005). Participants in the Tracy et al. study who had an SO when they entered treatment did not have better outcomes than those without an SO. However, relationship stability was significantly associated with outcome, such that individuals with intact relationships at one-year were more likely to be abstinent and less likely to have experienced negative consequences of substance use compared to individuals with relationships that had dissolved.

Treatments that incorporate the SO have been consistently more effective than individual treatment. Multiple studies comparing individual to couples therapy for alcohol problems have found interventions in which the SO is involved to provide significantly better treatment outcomes (Fals-Stewart, Klostermann, Yates, O'Farrell, & Birchler, 2005; Fals-Stewart, Birchler, & Kelley, 2006; McCrady, Epstein, Cook, Jensen, & Hildebrandt, 2009; Walitzer & Dermen, 2004). Fals-Stewart and colleagues (2005 & 2006) looked at couples in which the participant presented with an alcohol problem and their partner did not. In this group’s 2005 study, alcohol dependent men in the behavioral couples therapy condition had a significantly greater reduction in percentage days heavy drinking and a greater increase in marital satisfaction scores than men in individual behavioral therapy at 12 months posttreatment. In their 2006 study, women with an AUD and a non-abusing partner in the behavioral couples condition reported significantly fewer drinking days at 12 month follow-up compared to women in the individual behavior therapy or psychoeducational attention control conditions. They also reported higher relationship satisfaction. Thus, while in both studies the individuals in the couples intervention had better drinking outcomes compared to the control participants, these samples represent a very select group of problem drinkers (e.g. 38% of couples willing to participate in the 2006 study were excluded due to partner substance abuse). Another study from the same group used the same interventions for females diagnosed with a substance use disorder (Winters, Fals-Stewart, O’Farrell, Birchler, & Kelley, 2002). The results of this study found that women in the couples treatment had significantly higher PDA at 3, 6, and 9-month follow-ups, but by one year post-treatment were not different from the control intervention. McCrady et al. (2009) found that women who received couples therapy for their AUD showed a greater rate of improvement during treatment than those receiving only individual therapy. Of note, in this study, women whose SO also had an alcohol use disorder were included.

Not only have studies found that couples-oriented alcohol interventions produce more positive drinking outcome results than individual-based intervention comparison groups, but they also have found improvements in other areas of participants’ lives. As would be expected, couples who receive such treatments show significant increases in the quality of their marital relationship (McCrady, Stout, Noel, Abrams, & Nelson, 1991; Winters et al., 2002) after therapy. Couples-focused alcohol therapy also has been shown to reduce the occurrence of domestic violence (O'Farrell, Murphy, Stephan, Fals-Stewart, & Murphy, 2004) and increase children's well being (Kelley & Fals-Stewart, 2002).

Incorporating a significant other into alcohol use treatment has important and meaningful implications for both favorable outcomes of the presenting problem of alcohol abuse and more general quality of life issues. One of these factors, relationship satisfaction, is not only affected by couples-focused alcohol intervention techniques, but also can be a significant moderator of treatment outcome. It has already been mentioned that relationship stability is associated with better treatment outcomes (Tracy, Kelly, & Moos, 2005). Studies also have shown that pretreatment levels of marital satisfaction significantly predict men's ability to remain abstinent (McCrady, Hayaki, Epstein, & Hirsch, 2002), while poorer marital satisfaction is a predictor of poorer response to treatment (McCrady, Epstein, & Sell, 2003). Thus, marital satisfaction is an important factor to consider when considering treating AUDs with SO involvement.

Beneficial effects of members of drinkers' social networks are not confined to romantic partners or to the actual treatment context. CSOs have been shown to play critical roles in getting substance abusing loved ones to seek treatment (Cunningham, Sobell, Sobell, & Kapur, 1995). Unilateral family therapy (UFT) has been shown to be effective at reaching unmotivated substance abusers through CSOs. In a study of 55 concerned spouses, UFT was significantly associated with improved CSO coping and reduced drinking (Thomas & Ager, 1993). In a study examining the effectiveness of Community Reinforcement and Family Training (CRAFT), of the 45 CSOs of problem drinkers assigned to the CRAFT condition, 64% were successful in getting their unmotivated loved one into treatment (Miller, Meyers, & Tonigan, 1999). Of note, in this study CRAFT was expanded to nonspouse CSOs, and the authors stated that "it is reasonable to expect that nonspouse CSOs can benefit from interventions" (p. 690) as well. In a later study by the same group, again examining CRAFT expanded to include nonspouse CSOs, 67.9% of 59 CSOs assigned to the CRAFT conditions were able to get their loved one into treatment (Meyers, Miller, Smith, & Tonigan, 2002). Thus, CSOs are not only potent influences within the treatment framework, but also are effective at getting individuals into treatment.

Thus, alcohol use is a complex phenomenon upon which social factors exert significant influence. Interventions that involve a CSO are more effective than individual treatment and, within couples-based therapies, greater relationship satisfaction is associated with even better outcomes. The theory behind such interventions draws from three perspectives: 1) models that conceptualize drinking as learned behavior, 2) models that view drinking within an interactional framework, and 3) social exchange models (Longabaugh et al., 2005). From a learning theory perspective, the CSO may become an alcohol-related cue that can serve to either encourage or discourage drinking. From an interactional perspective, it is impossible to view an individual's drinking independent from their intimate environment, notably their CSO. Finally, from a social exchange framework, the couple can have high rates of positive or negative reinforcers that foster or inhibit drinking. To date little has been done to examine mechanisms by which such treatments work. McCrady et al. (2002) identified some predictors of change, finding support for the hypothesis that individual factors, spouse coping, and relationship quality all contributed to alcohol factors. Theory abounds about why network-focused interventions work, but there is a paucity of research into the mechanisms behind such treatments.

The purpose of the current study was to add information on such mechanisms. Drawing from the importance given to the principles of learning theory when considering the CSO in alcohol use interventions, cue reactivity provides one possible paradigm under which to examine the effects of the CSO. According to the learning framework, the CSO becomes a discriminative stimulus for drinking or abstinence. Thus, the presence of the CSO may affect cue reactivity to alcohol as a cue salient to drinking. This presence may be either positive or negative depending on the nature of the relationship between the individual and their CSO. Similarly, from the social exchange perspective, the presence of the CSO may serve to reinforce either abstinence or drinking. Accordingly, alcohol cues may have more or less salience in the presence of the CSO. Finally, from an interactional perspective, one must consider cue reactivity to alcohol in the presence of the CSO, as responses to alcohol are rendered meaningless independent of the environment in which drinking occurs. Regardless of the precise pathway, cue reactivity to alcohol should be affected by the influence of an individual's CSO. It is based on this logic that the neural regions commonly associated with alcohol craving are of interest in the current study.

In summary, reactivity to alcohol is highly dependent on contextual cues. The literature has shown that social support is a highly salient and influential context. Little is known, however, about the mechanisms by which social support in general, or a particular CSO, influences drinking and response to alcohol cues. While there currently is no research on this topic in the alcohol field, a few studies suggest that a CSO can alter neurological responses to different stimuli. For example, in a study of patients with fibromyalgia, the presence of the CSO resulted in reduced brain activity, measured via magnetoencephalography, in the somatosensory cortex and higher pain thresholds compared to when the participant was alone (Montoya, Larbig, Braun, Preissl, & Birbaumer, 2004). Another study found that while holding the hand of their spouse, women in highly satisfactory marriages had attenuated neural responses in the ACC, right dorsolateral PFC, superior colliculus, and posterior cingulate as well as subjective arousal to threat of an electric shock (Coan, Schaefer, & Davidson, 2006). Although scarce, the evidence that currently exists suggests that the presence a CSO has significant effects on both subjective affect and neurological activity. Based on this knowledge, the current study was conceived to test similar differences in the presence or absence of a CSO.

The overall aim of the current study was to investigate if a problem drinker's significant other affects how the drinker responds to alcohol cues. Cue reactivity was measured both by neural activation and self-reported urge to drink. As alcohol use levels of both the participant and CSO, along with relationship satisfaction and support have been seen to exert effects on subsequent drinking, these variables were measured and included in statistical analyses. The specific hypotheses to be tested were:

1) Presence of Concerned Significant Other. It was hypothesized that presence of the CSO would significantly attenuate alcohol dependent individuals' neural response to alcohol cues in the anterior cingulate cortex, medial prefrontal cortex, and striatum.

2) Social Support. It was hypothesized that within the hand-holding condition, CSO support for abstinence would be negatively associated with individuals' neural response to alcohol cues.

3) Relationship Quality. It was hypothesized that within the hand-holding condition, the reduction in neural response to alcohol cues would be greater in individuals with higher levels of relationship satisfaction.

4) CSO Alcohol Use. It was hypothesized that level of CSO alcohol use would be positively correlated with participant neural response to alcohol cues in the presence of the CSO.

Method

Participants

Sixteen dyads (consisting of a participant, herein referred to as the IP, and a CSO) were recruited. Any individuals participating in an ongoing neuroimaging study were considered eligible for the present study. From the parent study, inclusion criteria for IPs were: 1) a minimum of 21 years of age, and 2) reported drinking within the previous three weeks. IPs were excluded if they reported: 1) any history of treatment for alcohol dependence or desire for treatment, 2) a history of severe alcohol withdrawal and/or treatment for alcohol withdrawal, 3) a history of injury to the brain or brain related medical problems, 4) currently taking any psychotropic medications (e.g., antidepressants, antipsychotics, anxiolytics, etc.) or medications contraindicated for concurrent use of alcohol (e.g., sedatives), 5) a positive result on a pregnancy screen (females only), and 6) being left handed. For the present study, IPs were excluded if they could not identify a CSO willing to participate in the study. To be included in the present study, CSOs: 1) must have had contact with the IP for at least 40% of days in previous 3 months, and 2) must have been able to attend the scanning session with the IP. Exclusion criteria for CSOs were any medical or physical contraindications for being in the room with the MR scanner. Sample demographics are provided in Table 1. IPs and CSOs did not differ significantly on their ratings of relationship satisfaction or how often they drank with their partner.

Table 1 Here

Measures

The Dyadic Adjustment Scale (DAS: Spanier, 1976) is a 32-item measure that assesses the general satisfaction of an intimate relationship. It yields an overall Total score and four subscores: Dyadic Satisfaction, Dyadic Cohesion, Dyadic Consensus, and Affectional Expression. The DAS has demonstrated strong overall reliability and validity (Spanier, 1976). The DAS was given only if the CSO was an intimate partner of the partner. If so, it was administered to both the IP and CSO. In cases where the CSO was not a romantic partner, both members of the dyad were asked to answer only question 31 of the DAS. This question asks participants to rate their happiness with their relationship on a seven-point Likert scale, with 1 being “extremely unhappy” and 7 being “perfect”.

The 30-Day Timeline Followback (TLFB: Sobell, Maisto, Sobell, & Cooper, 1979) is an assessment technique that obtains estimates of daily drinking over a specified period of time. Using information gathered from the TLFB, percent days abstinent (PDA), drinks per drinking day (DDD), and total drinks can be calculated. The TLFB has been shown to have high inter-rater reliability and excellent validity in multiple populations, clinical and nonclinical (Green, Worden, Menges, & McCrady, 2008). This measure was completed by the IP only.

The Graduated-Frequency (GF: Clark & Midanik, 1982) Measure was used to assess average drinking levels of the CSO. This index provides general information pertaining to the pattern and quantity of the CSO’s level of alcohol use. The GF Measure has been seen to yield more sensitive estimates of high risk drinking than other common quantity-frequency measures (Rehm et al., 1999). This measure was completed by the CSO only.

The Important People Interview (IPI: Clifford & Longabaugh, 1991) assesses a person's involvement in their social network and activities, and determines levels of social support. This measure assesses both perceived and actual general and alcohol-specific social support. Adapted forms of this measure were used in this study so that the participants answered questions only about their CSO and the CSO answered questions about themselves concerning the participant. The psychometric properties of the IPI are not well established, in part due to the multitude of scoring systems. However, it is considered to be a useful and comprehensive instrument for measuring social support, and its adaptability can also be a strength (Groh et al., 2007).

The Drinking Inventory of Consequences (DrInC: Miller, Tonigan, & Longabaugh, 1995) is a 50-item self-report measure that assesses negative consequences related to alcohol use in five domains: interpersonal, physical, social, impulsive, and intrapersonal. It has been shown to have good reliability and validity in multiple domains (Forcehimes, Tonigan, & Miller, 2007). This measure was completed by the IP only.

The Alcohol Urge Questionnaire (AUQ: Bohn, Krahn, & Staehler, 1995) is an 8-item questionnaire that measures current drinking urges. Participants answer on a 7-point Likert scale, with a 1 being "strongly disagree" and 7 being "strongly agree". Participants endorse the extent to which they agree or disagree with statements related to desire to drink (4 items), desired expectancies of drinking (2 items), and inability to avoid drinking if alcohol was present (2 items). The AUQ has good validity and high internal consistency, with evidence suggesting that measurements collected by the AUQ become more stable with prolonged abstinence (Bohn et al., 1995; Drummond & Phillips, 2002). This measure was completed by the IP following the cue reactivity paradigm.

Procedure

Participants were recruited from an ongoing neuroimaging study examining how the neural response to alcohol is affected by genetic factors, such as polymorphisms of a dopaminergic receptor gene. Due to the expected difficulty recruiting CSOs, any individual within a participant's social network was permitted, provided the IP had in-person contact with the person at least four out of seven days a week. CSOs were only excluded if any contraindications to being in the same room in the MRI magnet (e.g. metal implants, pacemakers) were identified. However, attempts were made to recruit romantic partners whenever possible. This was done as the literature on alcohol social support has had a strong focus on intimate partners, and they were hypothesized to likely exert a greater effect on the IPs in the present experimental paradigm.

After completion of the parent study, potential subjects were approached and asked if they would be willing to participate in an additional study examining neural responses to alcohol cue. They were told that the scanning procedure in this study was quite similar to the one in the study they just completed. The only major difference would be that they would be asked to bring in a member of their social network. Individuals expressing interest in participating were asked to provide contact information and determine if they had a romantic partner, family member, or friend also willing to participate. Potential IPs were then contacted by phone to schedule a scanning time when both the IP and their CSO were available.

Upon arriving for the scanning session, both the IP and CSO were consented. All scanning sessions took place at the Mind Research Network (MRN) in Albuquerque, NM. Participants were fitted with non-ferrous vision corrected lenses if needed and were oriented to the cue-reactivity paradigm with a brief practice period during which instructions were provided via intercom by the MR technician. Participants were in the scanner approximately 45 minutes. Upon completion of the scanning session, participants were asked to complete the assessment battery, including rating their current level of craving. The entire protocol took an average of an hour and half, and all participants were compensated 25 dollars for their time. All study procedures and measures were approved by the UNM Human Research Review Committee (HRRC).

IPs were randomly assigned to one of two conditions prior to entering the scanner. A randomized sequence was created using a random number generator in Microsoft Excel. Participants were then assigned to one of the two conditions based upon order of entry into the study. In one condition, IPs completed the first cue reactivity trial alone and the second trial in the presence of their CSO. In the other condition, the first cue reactivity trial was completed with the CSO present and the second trial with the IP only. This counterbalanced design was utilized to control for time effects. For the trials when the CSO was present, the CSO was brought into the scanner room and asked to hold the IP's hand while they completed the cue reactivity. A previous study found that the simple act of hand-holding significantly attenuated the neural response to threat (Coan et al., 2006). Thus, due to the ease and experimental control of this procedure, hand-holding was used in this study to assess the effects of the CSO's presence.

Cue-reactivity paradigm. Taste stimuli were delivered to the participants in 1-milliliter increments via Teflon tubing using a computer-controlled delivery system. IPs received their preferred alcoholic beverage or a control beverage (litchi juice). Litchi juice was selected as the control beverage to provide an appetitive stimulus given that previous research has shown non-specific activation of the mesocorticolimbic circuitry in response to juice cues (see Filbey et al., 2008). Six trials of each beverage administration were delivered in a pseudo-randomized sequence. Each trial consisted of a 24 second taste delivery period, followed by 16 second washout period. Along with the gustatory stimuli delivery, visual stimuli also were presented instructing the participant to taste and swallow at the appropriate times. After the washout period, participants were asked to rate their subjective craving. This paradigm had been piloted and tested previously and been shown to elicit alcohol-specific activation of the mesocorticolimbic system (Filbey et al., 2008). Functional imaging data were collected throughout. IPs were asked to rate their subjective craving immediately after completing the scanning protocol.

fMRI data acquisition. Standard echo planar imaging (EPI) images (1.5 x 1 x1 mm) were obtained using a Siemens 3T MR scanner. Both anatomical and functional images were acquired. Whole-brain fMRI scans were acquired with 33 slices using a repetition time of 2000 ms. Other data acquisition parameters were: echo time = 20 ms, flip angle = 75°, field-of-view (FOV) = 24 cm, and a slice thickness of 3.5 mm without inter-slice gap. An interleaved slice acquisition sequence was used. During data acquisition, foam pillows were used to maximize the comfort of the participant in an attempt to minimize movement during the scanning procedure. Additionally, a piece of cloth tape was placed across the participant's forehead as an extra measure to ensure minimal head movement. Stimulus presentation was delivered using E-Prime (for visual presentations) and Infinity Controller (for gustatory presentations).

Statistical Analysis

fMRI data pre-processing. Before any statistical analyses, the first seven volumes of each EPI run were discarded to allow the magnetic resonance (MR) signal to reach steady state. The remaining volumes were motion corrected using SPM5's (Statistical Parametric Mapping) INRIAlign program. Of the 16 participants, only three moved more than 2 mm, with the maximum movement being slightly less than 4 mm. Upon inspection of individual data for all runs, data for all participants were determined to be usable. Data were spatially smoothed using a Gaussian kernel of 8 mm.

Based on the techniques of Filbey et al. (2008), explanatory variables (i.e. taste and baseline periods for alcohol and juice trials) were created by convolving stimulus timing files with a hemodynamic response function in SPM5. Due to the method of data collection, the hemodynamic response curve is captured as a number of discrete time points. The hemodynamic response function serves to correct for time delays between stimulus presentation and changes in blood oxygenation, as well as to smooth the increase in blood flow. Thus, integrating the timing of stimuli presentation with the hemodynamic response function is standard practice to more accurately capture the natural response of neural activity. A multiple linear regression analysis was performed to estimate the hemodynamic parameters for the different explanatory variables and the resulting *t*-statistic indicates the significance of the activation of the stimulus. Contrast maps were then created by contrasting 1) alcohol baseline vs. juice baseline conditions,

2) alcohol taste vs. alcohol baseline conditions, and 3) alcohol taste vs. juice taste conditions. Alcohol taste and juice taste correspond to neural activation during presentations of the relevant stimulus. Baseline conditions correspond to periods of no stimulus delivery. The contrast maps were then registered to the Montreal Neurological Institute (MNI) template.

Regions of interest (ROIs). Based on previous imaging research on alcohol-cue reactivity, social attachment, and presence of the CSO, specific neural regions were identified *a priori* as likely areas to have differential activation based on the experimental manipulations. These regions included the striatum, anterior cingulate cortex (ACC), and medial prefrontal cortex (mPFC). For each ROI, an anatomical mask was created in SPM5 and the mean of the voxels contained within each area was used as the activation level of each ROI. Statistical corrections were planned by thresholding with a voxel-corrected significance level of $p = 0.05$. Due to the importance of the dorsolateral PFC in emotion regulation and its observed activation in other studies examining effects of the CSO (see Coan et al., 2006; Montoya et al., 2004), this area also was examined. Exploratory whole-brain analyses were also planned to investigate additional areas that might be significantly activated in response to the experimental manipulations. To control for multiple comparisons, images were thresholded at $p = 0.001$. For each hypothesis tested, results were examined for each ROI and at the whole-brain level.

2nd-level statistical analysis. First, the effect of the cue-reactivity paradigm was tested. To determine the main effect of alcohol, a one-sample *t*-test was run using the contrast of alcohol taste vs. juice taste conditions during the no-hand condition only. Results were examined to determine areas of alcohol-specific significant activation. Next, the main effect of hand-holding was tested using a paired *t*-test comparing the hand-holding condition to the no-hand condition at baseline (i.e. the contrast map of alcohol baseline vs. juice baseline).

To test the primary study hypothesis (hypothesis 1) that presence of the CSO would significantly attenuate alcohol dependent individuals' neural response to alcohol cues, the interaction effect of alcohol X hand-holding condition was tested using a paired *t*-test of the two conditions comparing across the contrast of alcohol taste vs. juice taste. The secondary hypotheses were tested by entering the relevant variable into the paired *t*-test framework as a covariate, and examining the interaction between hand-holding condition and the entered variable. Thus, to test hypothesis 2, the effect of social support, a participant's response to perceived support for abstinence on the IPI, was entered and the interaction between support for abstinence and hand-holding condition was examined. Hypothesis 3, the effect of relationship satisfaction, was tested by entering a participant's answer to item 31 of the DAS, "how happy are you with your relationship" into the model and examining the interaction between DAS response and hand-holding condition. Hypothesis 4, the effect of CSO alcohol use, was tested by entering the CSO's GF score and examining the interaction with hand-holding condition.

Results

Effect of Alcohol Cue Reactivity

ROI analyses during the no-hand condition using the alcohol taste vs. juice taste contrast were all non-significant. This was unexpected due to previous findings of the same paradigm in the same areas. Significant results of whole-brain analyses are presented in Table 2. Of interest when considering the larger body of research, alcohol-specific activation of the insula was observed. The insula has been implicated in recent findings as an area involved in cue reactivity to alcohol and drugs in people with substance abuse problems (Schneider et al., 2001). The Brodmann area 40, located in the parietal cortex, is associated with working memory tasks. Overall, however, the activation of the mesocorticolimbic system that has been found to be robust in previous studies of alcohol cue reactivity was absent in the present sample.

Table 2 Here

Effect of Hand-holding Condition

Similar to the alcohol effect, no significant effects were observed in any of the ROIs when comparing baseline activation across the two experimental conditions. In this case, this was not only expected, but desired as it shows that the effect of holding the hand of one's CSO does not differentially affect neural activity during baseline. Whole-brain analyses showed no increased activation levels in the no-hand condition over the hand-holding condition. Some areas were observed to have increased activation in the hand-holding condition (Table 3). The middle temporal gyrus (BA 21) has been suggested to be involved with recognition of known faces. Thus, it is possible that the activation of the middle temporal gyrus observed in the present sample while the CSO is present may indicate some process of incorporating the CSO while undergoing the cue reactivity paradigm.

Table 3 Here

Interaction Effect of Hand Condition by Alcohol Cue Reactivity

No significant results were found in the *a priori* ROIs. This was not surprising, considering the non-significant effects of alcohol presentation. Whole-brain analyses resulted in a small number of areas of significant activation. The results are listed in Table 4. The inferior frontal cortex (BA 47) is believed to be involved with decision-making capacities. This area, a subregion of the mPFC, also has been previously implicated as significantly activated in individuals with AUDs compared to controls when exposed to alcohol cues (Tapert et al., 2003).

Table 4 Here

Effects of CSO Support for Abstinence, Relationship Satisfaction, and CSO Level of Drinking

Although the primary hypothesis of the effect of the interaction of hand condition by alcohol cue reactivity yielded minimal significant findings, the secondary hypotheses were tested to examine if controlling for the variance of those variables produced significant activations of neural areas. The test of hypothesis 2 (CSO support for abstinence) resulted in a significant activation of the left medial frontal gyrus (BA 11, MNI coordinates: -6, 51, -15, peak z-score = 3.15) in the hand-holding condition over the no hand condition. This area is a subregion of the mPFC, specifically the orbitofrontal cortex, and is involved in planning, reasoning and decision-making. The test of hypothesis 3 (relationship satisfaction) resulted in the same finding of a significant activation of the left medial frontal gyrus (BA11, MNI coordinates: -6, 51, -15, peak z-score = 3.19). The test of hypothesis 4 (CSO level of drinking) did not result in any areas of significant neural activation. Thus, when this variable was entered separately as a covariate, the significant activation of the right inferior frontal gyrus disappeared. Based on this finding, CSO level of drinking appears to influence neural response to alcohol.

Exploratory Post-hoc Analyses

Because the main effect of the alcohol cue reactivity paradigm was not reproduced as had been found in previous studies, exploratory analyses of the data were conducted *post-hoc* to investigate other possible explanations.

Effects of romantically involved CSOs. Much of the research regarding incorporation of the social network into the alcohol treatment framework has focused on romantic partners of problem drinkers. Romantic significant others have been shown to be strongly influential on treatment outcome, and it is likely that a manipulation such as hand-holding may be more impactful in a romantic relationship than in other relationships where that behavior may be less meaningful (e.g. in a platonic friendship where the friends never hold hands). As almost half of the dyads in the current study were romantic relationships (seven out of 16), the analyses described above were run again in the subset of dyads of a romantic nature. No meaningful differences were found in the seven romantic dyads compared to the entire study sample.

Effects of CSO support for abstinence, relationship satisfaction, and CSO level of drinking in the hand-holding condition. Although the interaction effect of hand condition by alcohol cue reactivity did not yield significant findings, it is of interest to examine how these variables may have affected alcohol cue reactivity within the hand-holding condition as possible evidence that the effects of the CSO's presence may change depending on the variables of interest. Table 5 presents the results of a one-sample *t*-test of the alcohol taste vs. juice taste contrast in the hand-holding condition. Similar to the interaction test of hand condition by alcohol cue reactivity, the results suggest that the presence of the CSO altered activity in the mPFC (inferior frontal cortex), suggesting the CSO may influence decision-making in the presence of alcohol cues.

Table 5 Here

When relationship satisfaction was entered into the analysis as a covariate, the significant activation in the left inferior frontal gyrus remained (BA 47, MNI coordinates: -24, 36, -9, peak z-score = 3.24). The same results were found when CSO level of drinking was entered as a covariate (BA 47, MNI coordinates: -24, 33, -9, peak z-score = 3.31). When CSO support for abstinence was entered as a covariate, not only was the left inferior frontal gyrus still significantly activated (BA 47, MNI coordinates: -24, 33, -9, peak z-score = 3.11), but the activation was observed to be bilateral in the right inferior frontal gyrus as well (BA 47, 2 local maxima with MNI coordinates: 27, 36, -12 and 30, 33, -15).

Time effects. Finally, in an attempt to understand the unexpected results of the alcohol cue reactivity paradigm, the time effects of completing the alcohol cue reactivity task twice were examined. The test-retest reliability of the taste experimental paradigm is currently unknown. A paired *t*-test was run comparing alcohol-specific cue reactivity in the first run of the paradigm to that of the second run, independent of hand condition. Results are presented in Table 6. Based on the results, it appears that participants habituated to the experimental paradigm. Especially of concern is the significant decrease in activation observed in regions of the medial prefrontal cortex, the middle frontal gyrus, an area implicated in previous studies of this paradigm (Filbey et al., 2008).

Table 6 Here

Additionally, the main effect of alcohol cue reactivity was tested in the 1st run across participants, regardless of hand condition. The results of this one-sample *t*-test are reported in Table 7. Interestingly, when only considering the 1st trial, many areas that were found to be significantly activated during this paradigm in previous studies were now found to be significantly in the current sample (examples include: left middle frontal gyrus, left thalamus, and the left fusiform gyrus). Thus, these findings suggest that there may be significant attenuation of cue reactivity over time. This is of special importance in regard to the present study, as participants not only completed the paradigm twice in one scan, but had previously been exposed and familiarized to the task.

Table 7 Here

Self-report measures. Due to the lack of consistent evidence of cue reactivity, and the potential questions about the test-retest reliability of the paradigm, self-report data were examined to explore whether the study sample might have been anomalous. The purpose of these analyses was to assess whether the self-report data from this sample produced similar relationships as those that have been observed in previous research or have been postulated from theoretical standpoints. Correlations of selected self-report variables are provided in Table 8. IP reports of how often they drank with their CSOs were significantly correlated with IP drinking. Number of heavy drinking days (HDD) was positively correlated with both IP and CSO self-report of how often the dyad drank together, indicating that higher HDD was associated with higher frequency of drinking of the dyad. Similarly, PDA was negatively correlated with IP and CSO self-report of how often the dyad drank together, indicating that lower PDA was associated with higher frequency of drinking of the dyad. CSO drinking was also positively correlated with IP HDD. These findings are consistent with previous findings in the literature that drinking behavior of the social network is associated with participant drinking behavior (Litt et al., 2007, Mohr et al., 2001).

Also as expected, IP negative consequences from drinking (measured via the DrInC) were significantly and positively correlated with IP self-reported craving (via the AUQ). Similar relationships between severity of alcohol problems and AUQ scores have been found in previous studies (Drobes & Thomas, 1999). Higher IP self-report of craving was significantly correlated with lower IP ratings of perceived CSO support for abstinence. This finding suggests that the attitudes of the CSO towards the IP's drinking may influence subjective alcohol craving. It also is consistent with the finding that network support for abstinence is associated with improved alcohol outcomes, as reduced reports of craving also have been correlated with improved alcohol outcomes (Drobes & Thomas, 1999). Along these lines, higher levels of CSO drinking were significantly correlated with lower IP ratings of perceived CSO support for abstinence, suggesting that CSOs are less supportive of abstinence when they themselves are heavier drinkers. Again, this finding is consistent with previous findings that heavier drinking networks negatively predict treatment outcomes, while higher levels of support for abstinence are associated with more favorable treatment outcomes (Kaskutas, Bond, & Humphreys, 2002).

Finally, relationship satisfaction was found to be significantly associated with some key variables. Both IP and CSO ratings of relationship satisfaction were negatively correlated with HDD and positively correlated with PDA. Thus, IPs with higher levels of relationship satisfaction reported fewer heavy drinking days and greater PDA. Increased relationship satisfaction consistently has been found to be associated with improved treatment outcomes (McCrady et al., 1991; Winters et al., 2002). This trend was found to exist for CSO drinking as well, as both IP and CSO ratings of relationship satisfaction were significantly and negatively correlated with CSO drinking level. CSO relationship satisfaction was significantly and negatively related to the frequency with which the dyad drank together, suggesting that dyads that drank together less were happier. Although no current findings exist in the literature regarding this particular finding, it makes sense from the theoretical position that dyads that drink together more frequently may be more distressed due to lack of positive interactions (Longabaugh et al., 2005). The drinking likely serves to make interactions more favorable. For example, research has shown that relationship satisfaction is higher in marriages where both spouses drink heavily compared to only one heavy drinking spouse (Homish & Leonard, 2007; Roberts & Leonard, 1998).

Table 8 Here

Discussion

The purpose of the present study was to examine the effects of the presence of a CSO on neural reactivity to alcohol cues. Four hypotheses were tested. The primary hypothesis was that presence of the CSO would attenuate the neural response to alcohol cues. The results of the primary hypothesis partially supported the hypothesis in that significant activation of the inferior frontal cortex was observed across hand-holding conditions. The second hypothesis was that CSO support for abstinence would moderate the effect of the hand-holding condition on alcohol cue reactivity. The findings of this test partially supported the hypothesis, as the left medial frontal gyrus was significantly activated in the hand-holding condition compared to the no hand-holding condition. The third hypothesis was that relationship satisfaction of the dyad would moderate the effect of the hand-holding condition on alcohol cue reactivity. Similar to the second hypothesis, the third hypothesis was partially supported, as the left medial frontal gyrus was significantly activated across hand-holding conditions. The fourth hypothesis was that CSO level of drinking also would moderate the effect of the hand-holding condition on alcohol cue reactivity. The fourth hypothesis also was partially supported, as results showed no significant differences in neural activation across conditions when CSO drinking was entered into the model.

Evidence for the primary hypothesis, that the presence of a CSO should attenuate the neural response to alcohol cues, largely was inconclusive, most likely because widespread attenuation of the mesocorticolimbic response to alcohol cues did not occur in the current sample. However there were a number of potential limitations (addressed below) to the present study that may account for this finding. The results of the hand-holding manipulation on alcohol-specific neural activation suggested some effect on cue reactivity in areas of the medial prefrontal cortex, an area believed to be involved with decision-making capacities. When considering the hand-holding condition only, activation of this area also was observed. Interestingly, this area has been previously implicated as significantly activated in individuals with AUDs compared to controls when exposed to alcohol cues (Tapert et al., 2003). Thus, areas of the frontal cortex associated with decision-making appear to be significantly activated in response to alcohol-specific cues in the presence of the CSO. This suggests that the presence of the CSO may affect attentional processes and planning in response to alcohol cues.

Relationship satisfaction and perceived CSO support for abstinence appeared to influence the effect of the presence of the CSO on neural response to alcohol. Similarly to CSO drinking levels, the activation of the inferior frontal cortex was attenuated when either relationship satisfaction or support for abstinence were taken into consideration. However, nearby activation of the orbitofrontal cortex was observed when relationship satisfaction or support for abstinence was controlled for. This area is involved in planning, reasoning and decision-making and has been implicated as being disrupted in substance abusers (Filbey et al., 2008). Thus, when taking relationship satisfaction or support for abstinence into consideration, not only is the activation of some areas reduced in the presence of the CSO in response to alcohol cues, but activation in other areas is increased. Importantly, these areas are implicated both as being activated in response to substance-related cues as subregions of the mPFC (Filbey et al., 2008; Sinha & Li, 2007; Wrase et al., 2007) and as being activated differentially in individuals with SUDs versus controls (Myrick et al., 2004; Tapert et al., 2003). While the results of the present study make it difficult to draw definitive conclusions, the findings provide suggestive evidence that the presence of a CSO influences neural activity in cortical regions associated with alcohol cue reactivity and problematic drinking.

No significant differences in neural activation between the hand-holding conditions were found for the effects of CSO drinking levels. This finding, in contrast to the significant activation of the inferior frontal region of the mPFC when this variable was not included in the model, suggests that activation of the frontal cortex in response to alcohol cues is modulated by characteristics of the CSO. In other words, the pattern of activation of the mPFC (which has been associated with AUDs) is significantly attenuated when the drinking level of the CSO or the level of perceived support for abstinence is taken into account. This finding provides some support, although perhaps less compelling than expected, for the hypothesis regarding the attenuating effects of CSO drinking behavior. The results suggest that the drinking of the CSO may serve as a conditioned cue that can either activate or attenuate responses to alcohol depending on CSO drinking behavior.

The results suggest that members of drinkers' social networks can affect neural alcohol cue reactivity in meaningful ways. Specifically, the presence of a CSO appeared to alter alcohol-specific neural activity in interior frontal and orbitofrontal areas associated with integrating sensory information, decision-making, and evaluation of reward. The orbitofrontal cortex has been implicated in evaluating predicted reward values of various behaviors (Kringelbach, 2005). Thus, members of a drinker's social network may serve as important environmental stimuli when evaluating the potential rewarding and pleasurable aspects of alcohol use. The CSOs were not actively engaging in any behavior to directly affect drinking behaviors; simply their physical presence was manipulated in this study. Yet that presence appeared to alter neural reactivity specific to alcohol. This finding is consistent with the overarching conceptualization of members of the drinker's social network as conditioned alcohol cues, as alcohol-related cues serve as passive environmental stimuli that promote alcohol use. The findings of the current study suggest that the passive influences of social support networks may affect responses to alcohol, in addition to the active behaviors of those same social networks.

There are several limitations of the present study. First, the previous robust findings of activation of the mesocorticolimbic system in response to alcohol cues were not replicated. Numerous studies have found significant activations of this system (George et al., 2001; Myrick et al., 2004; Schneider et al., 2001; Wrase et al., 2002; Wrase et al., 2007), including a study using the identical taste paradigm (Filbey et al., 2008). The cue reactivity paradigm utilized in this study was selected due to the robustness of elicitation of alcohol-specific neural activity, but this effect was not observed in the current study. This is a major limitation, as the effect of interest was an interaction of alcohol cue reactivity hand-holding conditions. Without the main effect of alcohol cue reactivity, the ability to make a definitive statement about impact of the CSO on cue reactivity is tenuous at best.

As the alcohol effect on neural activity has been found previously, it was of interest in this study to investigate why the effect was not found. The test-retest reliability of the cue reactivity paradigm is currently untested, yet the theoretical basis of Cue exposure therapy (CET) suggests that repeated exposure to the previously novel cue reactivity paradigm may result in an altered response. CET posits that conditioned responses to alcohol lead to alcohol use, and that those responses can be unconditioned much in the way they were initially conditioned. Thus, if a stimulus is consistently followed by alcohol consumption, it becomes an alcohol-related cue. Similarly, if an alcohol-related cue is consistently associated with no alcohol consumption, it loses it alcohol-related quality. Relevant to the present study, participants had already been exposed to the cue reactivity paradigm through their involvement in a previous study. This design feature, in particular, may be important due to the extremely novel experience of being put into an fMRI machine and completing an artificial task. The first exposure to the paradigm may have served as an extinction trial, and previous research has shown that exposure to alcohol cues in the same context as a previous extinction trial results in reduced cue reactivity (Collins & Brandon, 2002). Additionally, they underwent the paradigm twice for the present study. Thus, they may have become conditioned to the paradigm, especially in light of the fact that participants did not receive alcohol at the end of the study (the amount of the alcohol consumed during the paradigm was negligible). Previous research has shown that when participants know they will not be receiving alcohol at the end of the experimental paradigm cue reactivity is reduced (MacKillop & Lisman, 2005). The novelty of the current experimental procedure is likely to be alien to any real-world experience of the participant, as well as expectancies of the participant regarding alcohol consumption. Therefore, conditioning may have occurred rapidly, and that conditioning is likely to have attenuated any alcohol-related responses.

The results of the post hoc analyses support the possibility that repeated exposure to the experimental paradigm resulted in habituation. Significant reductions in neural response to alcohol were observed from the first run to the second run, independent of hand-holding condition. Moreover, when hand-holding condition was ignored and the first alcohol cue exposure run for all participants was examined, a greater level of neural activation was observed. Many of the areas of activation observed in the first run were consistent with previous findings regarding alcohol-specific neural response (Filbey et al., 2008; Wrase et al., 2007). Thus, these findings suggest that effects of conditioning over time may have interfered with the ability to detect any effects of the manipulation of presence of CSO.

There are a few other potential limitations to the present study. Due to constraints of time and funding, a sample of only 16 dyads was collected. Although numerous neuroimaging studies have been published with sample sizes between ten and twenty participants, this sample size is considered to be on the lower end of sample sizes necessary to detect significant effects. This reduction in power to detect effects is especially relevant when it comes to the secondary hypotheses testing potential moderating variables influencing the effect of hand-holding. That coupled with the strong exploratory nature of the study may have limited the ability to detect significant effects of the presence of the CSO. Thus, the results should be interpreted with the knowledge that the sample may have been too small to detect the effects of the experimental condition. Additionally, extreme neural activity on the part of even a few of the participants could have strongly influenced the overall results. For example, two of the IPs had almost global neural activation when exposed to alcohol cues. In a small sample, such participants may have heavily influenced the ability to detect effects.

Another limitation of the study was the heterogeneity of the CSOs. The selection of inclusion and exclusion criteria for CSOs was an important issue in the design;

ultimately homogeneity of the CSO sample was sacrificed in the interest of study feasibility. It was decided that getting a participant and his/her CSO to agree to come in together during the already restricted times when the scanner was available would be difficult enough, and to further restrict the eligibility criteria for the CSO might render the study unfeasible. Thus, some concessions were made that may have reduced the strength of the design to detect significant effects. For example, in a study examining the effects of the spouse on attenuation of neural response to threat, only highly satisfied couples were used, in order to maximize any possible effects (Coan et al., 2006). In the current study, the only restriction put on the eligibility of the CSO was that the IP and CSO had to have face-to-face contact on at least four days of any given week. CSOs were not required to be of a specific relationship, have a certain level of importance, or provide a defined amount of support. In combination, the heterogeneity of the CSO sample may have reduced the effectiveness of the hand-holding manipulation, as holding the hand of one's spouse may be very different from holding the hand of one's brother or friend. Especially in an exploratory study of this nature, controlling for differences in CSOs might have enhanced the chances of finding some effects. This is a likely limitation when one considers the literature on the influence of different members of the social network on drinking behavior. For example, Beattie & Longabaugh (1997) found differential effects of family members versus friends when predicting alcohol treatment outcomes. Additionally, it has been found that simply having a spouse is associated with better treatment outcomes (Havassy et al., 1991). Clearly, not all members of a drinker's social network are created equal when it comes to improving treatment outcomes. It is logical to assume that varying facets of a drinker's social network might also affect the drinker's response to alcohol cues in different ways. In fact, research has shown that certain characteristics of the client affect how sources of support are viewed. For example, men are more likely to report family members as primary support sources, while women are more likely to report higher levels of support from friends (Rice & Longabaugh, 1996). Finally, much of the research examining the influence of the social network on alcohol uses outcomes focused on intimate partners, such as the spouse. By not restricting CSOs to romantic partners, the impact of holding the hand of the CSO may have been reduced. A more rigorous control of CSO selection may have bolstered the presence of any effects of the experimental manipulation.

That being said, attempts were made to increase the salience of the CSO. All participants were asked if they had a romantic partner who might be available to participate. If not, participants were then asked “to identify a family member or close friend who was very important to them” and they saw frequently. This recruitment strategy appeared to be effective in selecting important members of one’s social network, as the mean (*SD*) IP rating of CSO importance was 5.6 (*.72),* with a rating of 6 being “extremely important”. Additionally, the mean IP rating of general support was 5.4 (*.73),* with a rating of 6 being “extremely supportive”.

Finally, participants in this study were not currently seeking treatment for an alcohol use disorder. This is a potential limitation, as the majority of literature on the influence of social support on drinking has been conducted in treatment-seeking samples. They may have presented with less severe alcohol problems. For example, although the mean (*SD*) number of drinks per drinking day in the sample was 5.7 (*2.2*), the mean PDA was 58.1 (*21.8*). The PDA in this sample is higher than that of most other treatment studies (e.g. McCrady et al., 2002 reported a mean PDA of 40%, in Litt et al., 2007 the mean PDA was 28%). Thus, the social networks of the sample may also have differed in some important ways from the social networks of individuals actively seeking alcohol treatment. It is easy to imagine that members of a treatment-seeking drinker's social networks may have had an instrumental role in that person participating in treatment. Likewise, such individuals likely see their drinking as a problem. This is not necessarily the case in the present sample. Thus, it is possible that the relevance and impact of the CSO was qualitatively different from the impact of a CSO of a treatment-seeking individual. This is an issue that needs to be explored more in the literature, and may have been a limiting factor in the present study.

Despite these limitations, the present study also has important strengths. The first strength is the within-subjects design. A within-subject design was chosen as the issue of constraints on sample size was identified in the initial stages of study development. By opting for a within-subjects design, participants served as their own controls. This design increased statistical power and provided a more rigorous experimental design than that of a two-sample between-subjects design. By using participants as their own controls, the within-subjects design effectively doubled the possible sample size for comparison across hand-holding conditions.

Another strength of the study is the generalizability of the sample. Having identified the heterogeneity of the CSO sample as a potential limitation, it is also a potential strength of the study. By keeping the CSO eligibility criteria to a minimum, a broad range of social network members was ensured. Thus, the results are more likely to be generalizable to the whole social network, rather than a truncated source of social support. For example, while research focused on incorporating the spouses of individuals with AUDs has been shown to be highly effective, it is only applicable to the 35-44% of individuals in treatment with an intimate partner (e.g. Project MATCH Research Group, 1997; Stinchfield & Owen, 1998). The present study has various sources of social support in the sample, which serves to broaden the applicability of the results.

A third strength of the study involves the resources and staff of the Mind Research Network (MRN). The MRN is a leader in neuroimaging research, and employs experts in all aspects related to neuroimaging data collection and analysis. The investigators in this study had access to the resources of the MRN, and thus were given access to the cutting edge of fMRI techniques and analysis. Thus, state-of-the-art data collection was monitored and ensured by a full-time research staff and the research team had access to qualified data quality and analysis personnel well versed in the latest standards for fMRI research. Neuroimaging is a relatively new field, and as such, there is still considerable variability regarding data collection and analysis techniques encountered in the literature. Access to the expertise and knowledge of the MRN is a strength of the present study.

A final strength of this study is that self-report data were examined and a number of significant correlations that would be expected based on the alcohol social support literature were found. For example, studies have consistently found that higher relationship satisfaction is associated with improved treatment outcomes (McCrady et al., 2002; Tracy et al., 2005). Similarly, in this study, a significant correlation was found between relationship satisfaction and level of drinking for both the IP and CSO, such that higher relationship satisfaction was associated with lower drinking levels. Other research has shown that high levels of network support for abstinence are associated with improved treatment outcomes (Beattie & Longabaugh, 1999; Litt et al., 2007). In the current study, higher perceived support for abstinence from the CSO was correlated with lower negative consequences. These significant associations among self-report measures are important in two ways. First, the results suggest that some of the findings from the treatment literature may be relevant and possibly applicable to non-treatment seeking samples as well. This is especially true when considering the small sample size and the fact that significant correlations still emerged. Second, these data suggest that a wide range of CSOs may be able to influence drinking behavior. This is important, especially as treatments such as the Community Reinforcement Approach (CRA: Meyers & Smith, 1995) gain ground in the alcohol treatment field.

Several overarching conclusions emerged from the study. First, due to the difficulty encountered in evoking the expected neural activation patterns in response to alcohol cues, definitive conclusions could not be reached about the effect of the presence of a CSO on alcohol cue reactivity. No significant activation of the deeper mesolimbic structures, including the anterior cingulate cortex and striatum, were observed in this sample at any point of data collection. However, effects of the hand-holding condition were seen in the medial prefrontal cortex (mPFC). This area is implicated in neural cue reactivity to alcohol and is thought to be involved in higher cognitive functions such as evaluation of reward and decision-making. While being cautious not to overstate these findings, these results suggest that characteristics of the CSO, such as level of support for abstinence, CSO drinking level, and relationship satisfaction may affect executive function and decision-making more than the perceived rewards of alcohol.

Thus, this study provides some evidence, although admittedly tenuous, that the simple act of holding the hand of a member of one's social network alters the activity of specific neural regions associated in alcohol cue reactivity. This finding lends support to the overall conceptualization of the CSO as an important influence in problematic drinking behavior, and additionally, hints at the importance of specific variables to consider when evaluating the potential beneficial or detrimental influence of the social network on drinking behaviors. Further exploration into the specific mechanisms through which CSOs enhance or hinder treatment improvements is needed. By investigating the underlying processes of CSO involvement in drinking behavior, researchers and clinicians can better tailor and direct treatment procedures to maximize the beneficial aspects of incorporating the social network, while at the same time minimizing the detrimental effects of those same social networks. A better understanding of the influence of the social network and its members can also modify and advance the current theoretical framework that such treatments are based upon. With a more comprehensive theory, new avenues of research can emerge and foster the progress of our clinical effectiveness. Future research should continue examine the importance and influence of drinker's social networks on drinking behavior.

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List of Tables

Table 1. Sample Characteristics

Demographic	**IP (*n* = 16)**	**CSO (*n* = 16)**
Gender (%)		
Male	43.8	50
Female	56.3	50
Age (years)	24.3 (2.4)	26.3 (8.1)
Education (years)	15.6 (1.8)	15.0 (2.6)
Ethnicity (%)		
White	36.8	47.6
Latino	47.4	38.1
Native American	10.5	14.3
Asian	5.3	-
Relationship Satisfaction	5.4 (1.3)	5.3 (0.9)
How Often Drink Together (%)		
3+ times/week	18.8 (*n* = 3)	18.8 (*n* = 3)
1-2 times/week	50 (*n* = 8)	43.8 (*n* = 7)
Less than once a week	31.2 (*n* = 5)	37.4 (*n* = 6)
Relation to CSO (%)		
Spouse/SO	43.8 (*n* = 7)	
Friend	43.8 (*n* = 7)	
Parent	6.3 (*n* = 1)	
Sibling	6.3 (*n* = 1)	
Percent Days Abstinent (last 30 days)	58.1 (21.8)	n/a
Drinks/Drinking Day (last 30 days)	5.7 (2.2)	n/a
AUQ Score	27.9 (13.1)	n/a
DrInC Score	20.4 (16.9)	n/a
GF score	n/a	822.5 (1164.3)
GF category		
Light Drinker	n/a	43.8
Moderate Drinker	n/a	25
Heavy Drinker	n/a	31.3

*N/a = not assessed, AUQ = Alcohol Urge Questionnaire, DrInC = Drinking Inventory of Consequences, GF = Graduated-Frequency. 3 IPs and 5 CSOs noted more than one ethnicity.

Table 2. Significant Areas of Activation in Response to Alcohol Taste Cues

Localization	BA	Volume	Peak	x	y	z
L insula	13	9	3.88	-48	-36	24
R cerebellum		8	3.45	15	-48	-21
R supramarginal gyrus	40	6	3.2	63	-39	39
L cerebellum		8	3.17	-12	-42	-24
L cerebellum		8	3.15	-9	-51	-21
L cerebellum		2	3.15	-21	-51	-30
R inferior parietal lobule	40	2	3.15	45	-36	45
R inferior parietal lobule	40	1	3.14	66	-30	36

L = left, R = right, BA = Brodmann Area. From left to right, this table reports anatomical label, corresponding BA, volume of area of activation (number of voxels), maximum voxel activation within the activation cluster as a Z-score, and the Montreal Neurological Institute (MNI) space coordinates of the activation region along the three major axes. All activations significant at the $p < .001$ level.

Table 3. Significant Areas of Activation in the Hand-holding vs. No-hand Condition at Baseline

Localization	BA	Volume	Peak	x	y	z
R cerebellum		27	3.78	27	-75	-15
L cerebellum		5	3.83	-30	-87	-18
L Mid Temporal Gyrus	21	6	3.52	-63	-18	-12

L = left, R = right, BA = Brodmann Area. From left to right, this table reports anatomical label, corresponding BA, volume of area of activation (number of voxels), maximum voxel activation within the activation cluster as a Z-score, and the Montreal Neurological Institute (MNI) space coordinates of the activation region along the three major axes. All activations significant at the $p < .001$ level.

Table 4. Significant Areas of Activation of Hand Condition by Alcohol Taste Cues

Localization	BA	Volume	Max. Z	x	y	z	Alcohol	Hand
Pons		4	3.11	3	-18	-27	X	
R inferior frontal gyrus	47	3	3.3	30	39	-3		X

R = right, BA = Brodmann Area, Alcohol = significant activation of no-hand vs. hand condition, Hand = significant activation of hand vs. no-hand condition. From left to right, this table reports anatomical label, corresponding BA, volume of area of activation (number of voxels), maximum voxel activation within the activation cluster as a Z-score, and the Montreal Neurological Institute (MNI) space coordinates of the activation region along the three major axes. All activations significant at the $p < .001$ level.

Table 5. Significant Areas of Activation in Response to Alcohol Taste Cues in the Hand-holding Condition Only

Localization	BA	Volume	Peak	x	y	z
L inferior frontal gyrus	47	5	3.42	-24	33	-9
R inferior frontal gyrus	47	5	3.32	30	33	-15
L cerebellum		2	3.26	-27	-69	-42
L cerebellum		1	3.13	-48	-54	-36

L = left, R = right, BA = Brodmann Area. From left to right, this table reports anatomical label, corresponding BA, volume of area of activation (number of voxels), maximum voxel activation within the activation cluster as a Z-score, and the Montreal Neurological Institute (MNI) space coordinates of the activation region along the three major axes. All activations significant at the $p < .001$ level.

Table 6. Significant Areas of Activation Comparing Alcohol Cue Reactivity in the 1st Run vs. the 2nd Run

Localization	BA	Volume	Peak	x	y	z
L cerebellum		3	3.24	-36	-60	-39
R superior frontal gyrus	6	3	3.68	18	27	63
L mid frontal gyrus	6	1	3.17	-36	3	63
L mid frontal gyrus	10	4	3.21	-39	48	24
L mid frontal gyrus	10	1	3.15	-39	51	12
L precentral gyrus	4	2	3.27	-39	-9	63

L = left, R = right, BA = Brodmann Area. From left to right, this table reports anatomical label, corresponding BA, volume of area of activation (number of voxels), maximum voxel activation within the activation cluster as a Z-score, and the Montreal Neurological Institute (MNI) space coordinates of the activation region along the three major axes. All activations significant at the $p < .001$ level.

Table 7. Significant Areas of Activation in the 1st Run of the Alcohol Cue Reactivity Paradigm

Localization	BA	Volume	Peak	x	y	z
L cerebellum		86	4.35	-27	-69	-42
L cerebellum		86	3.8	-48	-54	-36
L cerebellum		2	3.16	-12	-81	-30
R supramarginal gyrus	40	42	3.73	63	-36	45
R inferior parietal lobule	40	13	3.35	45	-51	63
L inferior parietal lobule	40	9	3.24	-45	-45	54
L superior parietal lobule	7	24	3.49	-30	-60	60
R middle temporal gyrus	39	21	3.46	33	-51	36
L inferior frontal gyrus	47	2	3.42	-24	33	-9
R middle frontal gyrus	6	2	3.43	36	3	66
L superior frontal gyrus	6	6	3.32	-12	6	75
R middle frontal gyrus	6	1	3.1	42	3	63
L fusiform gyrus	37	2	3.32	-42	-36	-12
L thalamus		8	3.25	-18	-33	15

L = left, R = right, BA = Brodmann Area. From left to right, this table reports anatomical label, corresponding BA, volume of area of activation (number of voxels), maximum voxel activation within the activation cluster as a Z-score, and the Montreal Neurological Institute (MNI) space coordinates of the activation region along the three major axes. All activations significant at the $p < .001$ level.

Table 8. Pearson Correlations for Self-Reported Measures

	HDD (IP)	PDA (IP)	CSO Importance (IP)	How Often Drink Together (IP)	CSO Support for Abstinence (IP)	AUQ Score (IP)	DrInC Score (IP)	Relationship Satisfaction (IP)	IP Importance (CSO)	How Often Drink Together (CSO)	GF Score (CSO)	Relationship Satisfaction (CSO)
HDD (IP)	-	**-0.89****	0.34	**0.56***	-0.37	-0.09	0.37	**-0.62***	-0.39	**0.50***	**.54***	**-0.59***
PDA (IP)		-	-0.26	**-0.64****	0.42	0.24	-0.35	**0.60***	0.41	**-0.57***	-0.45	**0.56***
CSO Importance (IP)			-	0.18	-0.19	0.08	-0.27	0.14	0.26	-0.15	0.15	0.16
How Often Drink Together (IP)				-	0.01	**0.58***	0.37	-0.39	-0.43	**0.79****	**0.53***	**-0.59***
CSO Support for Abstinence (IP)					-	**-0.53***	-0.38	0.3	0.02	-0.31	**-0.59***	0.03
AUQ Score (IP)						-	**.60***	-0.17	-0.02	0.3	0.1	0.03
DrInC Score (IP)							-	-0.53	**-0.55***	0.1	0.3	-0.35
Relationship Satisfaction (IP)								-	0.45	-0.41	**-0.65***	**0.73****
IP Importance (CSO)									-	-0.37	-0.26	**0.81****
How Often Drink Together (CSO)										-	**0.54***	**-0.62***
GF Score (CSO)											-	**-0.54***
Relationship Satisfaction (CSO)												-

*p< .05, **p< .01, HDD = heavy drinking days, PDA = percentage days abstinent. IP or CSO in parentheses refers to person filling out the questionnaire. All correlation reported in Pearson *r*'s.

Appendix A

Alcohol Urge Questionnaire

Listed below are questions that ask about your feelings about drinking. The words "drinking" and "have a drink" refer to having a drink containing alcohol, such as beer, wine, or liquor. Please indicate how much you agree or disagree with each of the following statements by placing a checkmark (like this:__). The closer you place your checkmark to one end or the other indicates the strength of your disagreement or agreement. Please complete every item. We are interested in how you are thinking or feeling right now as you are filling out the questionnaire.

1. All I want to do now is have a drink.
STRONGLY DISAGREE:_____:_____:_____:_____:_____:_____:_____:STRONGLY AGREE

2. I do not need to have a drink now.
STRONGLY DISAGREE:_____:_____:_____:_____:_____:_____:_____:STRONGLY AGREE

3. It would be difficult to turn down a drink at this minute.
STRONGLY DISAGREE:_____:_____:_____:_____:_____:_____:_____:STRONGLY AGREE

4. Having a drink now would make things seem just perfect.
STRONGLY DISAGREE:_____:_____:_____:_____:_____:_____:_____:STRONGLY AGREE

5. I want a drink so bad I can almost taste it.
STRONGLY DISAGREE:_____:_____:_____:_____:_____:_____:_____:STRONGLY AGREE

6. Nothing would be better than having a drink right now.
STRONGLY DISAGREE:_____:_____:_____:_____:_____:_____:_____:STRONGLY AGREE

7. If I had a chance to have a drink, I don't think I would drink it.

STRONGLY DISAGREE:_____:_____:_____:_____:_____:_____:_____:STRONGLY AGREE

8. I crave a drink right now.

STRONGLY DISAGREE:_____:_____:_____:_____:_____:_____:_____:STRONGLY AGREE

Appendix B

Dyadic Adjustment Scale: Item 31

The stars on the following line represent different degrees of happiness in your relationship. The middle point, “happy,” represents the degree of happiness on most relationships. Circle the star below the phrase which best describes the degree of happiness, all things considered, of your relationship with ______.

Extremely Unhappy	Fairly Unhappy	A Little Unhappy	Happy	Very Happy	Extremely Happy	Perfect
*	*	*	*	*	*	*

Appendix C

Demographics Questionnaire

Demographics

1. Sex (circle one): Male (1) Female (2)

2. Age ____________

3. Marital Status (circle one):

1	2	3	4	5	6	7
Never Married	Married	Divorced	Widowed	Separated	Engaged	Living Together

4. If <u>married or living together</u>, how many years have you been married or living together? _________

5. Do you have any children living at home? YES (1) NO (0)
6. Total number of years of education _______________ (For example: Finished high school would be <u>12</u>)

7. Are you employed? (circle one)

   (3) = Full time, (even if suspended pending treatment)
   (2) = Part-time, odd jobs, **full-time student** or housewife
   (1) = Unemployed, disabled, retired, other

8. IF YES:
   What is your current occupation? _____________________________________

   How many hours per week do you work? (average) _________

   In the last 12 months, how many weeks were you employed

   full-time___________
   part-time but not full-time____________________

9. What is **your** present household income range in the past year (circle one):

1	2	3	4	5	6	7
$0- $9,999/yr	$10,000- $19,999/yr	$20,000- $29,999/yr	$30,000- $39,999/yr	$40,000- $49,999/yr	$50,000- $59,999/yr	over $60,000/yr

10. What is your ethnic background/race? Please check **all** that apply:

White	***Black***	***Asian***	***Latino***	***Native***
Adygei	African American	Chinese	Hispanic	Muskoke
Druze	Biaka (CAR)	Japanese	Chicano	Cherokee
Yemenite Jews	Mbuti (Zaire)	Korean	Mexican American	Cheyenne
Ashkenazi Jews	San Bushmen	Pacific Islander	Spanish	Pima
Roman Jews	Bantu (SA)	Thai	Other	Maya
Mixed European	Falasha	Vietnamese		Navajo/Dine/ Athabaskan
Sardinians	Other	Filipino		Mescalero

☝ Swedes	☝ Asian American	Apache ☝ Jicarilla Apache
☝ Danes	☝ Middle Eastern	☝ Pueblo (tribe)
☝ Finns ☝ Icelandic ☝ Other	☝ Other	___________ ☝ Other

OTHER: (PLEASE SPECIFY)**____**

Appendix D

CASAA Research Division

Drinker Inventory of Consequences (DrInC-2R)

FOR OFFICE USE ONLY
______Study
______ID
______Point
______Date
______Raid
DICO3MO- Revised 3/15/00 4 Pages

INSTRUCTIONS: Here are a number of events that drinkers sometimes experience. Read each one carefully, and indicate how often each one has happened to you *DURING THE PAST 3 MONTHS* by circling the appropriate number (0 = Never, 1 = Once or a few times, etc.). If an item does not apply to you, circle zero (0).

DURING THE PAST 3 MONTHS **about how often has this happened to you? Circle one answer for each item:**	Never	Once or a few times	Once or twice a week	Daily or almost daily
1. I have had a hangover or felt bad after drinking.	0	1	2	3
2. I have felt bad about myself because of my drinking.	0	1	2	3
3. I have missed days of work or school because of my drinking.	0	1	2	3
4. My family or friends have worried or complained about my drinking.	0	1	2	3
5. I have enjoyed the taste of beer, wine, or liquor.	0	1	2	3
6. The quality of my work has suffered because of my drinking.	0	1	2	3
7. My ability to be a good parent has been harmed by my drinking.	0	1	2	3
8. After drinking, I have had trouble with sleeping, staying asleep, or nightmares.	0	1	2	3
9. I have driven a motor vehicle after having three or more drinks.	0	1	2	3
10. My drinking has caused me to use other drugs more.	0	1	2	3
11. I have been sick and vomited after drinking	0	1	2	3

DURING THE PAST 3 MONTHS **about how often has this happened to you?** **Circle one answer for each item:**	Never	Once or a few times	Once or twice a week	Daily or almost daily
12. I have been unhappy because of my drinking.	0	1	2	3
13. Because of my drinking, I have not eaten properly.	0	1	2	3
14. I have failed to do what is expected of me because of my drinking.	0	1	2	3
15. Drinking has helped me to relax.	0	1	2	3
16. I have felt guilty or ashamed because of my drinking.	0	1	2	3
17. While drinking I have said or done embarrassing things.	0	1	2	3
18. When drinking, my personality has changed for the worse.	0	1	2	3
19. I have taken foolish risks when I have been drinking.	0	1	2	3
20. I have gotten into trouble because of drinking.	0	1	2	3
21. While drinking or using drugs, I have said harsh or cruel things to someone.	0	1	2	3
22. When drinking, I have done impulsive things that I regretted later.	0	1	2	3
23. I have gotten into a physical fight while drinking.	0	1	2	3

Please continue on the next page

Now answer these questions about things that may have happened to you:

DURING THE PAST 3 MONTHS **how much has this happened?** **Circle one answer for each item:**	Not at All	A Little	Some-what	Very Much
24. My physical health has been harmed by my drinking.	0	1	2	3
25. Drinking has helped me to have a more positive outlook on life.	0	1	2	3
26. I have had money problems because of my drinking.	0	1	2	3
27. My marriage or love relationship has been harmed by my drinking.	0	1	2	3
28. I have smoked tobacco more when I am drinking.	0	1	2	3
29. My physical appearance has been harmed by my drinking.	0	1	2	3
30. My family has been hurt by my drinking.	0	1	2	3
31. A friendship or close relationship has been damaged by my drinking.	0	1	2	3
32. I have been overweight because of my drinking.	0	1	2	3
33. My sex life has suffered because of my drinking.	0	1	2	3
34. I have lost interest in activities and hobbies because of my drinking.	0	1	2	3
35. When drinking, my social life has been more enjoyable.	0	1	2	3
36. My spiritual or moral life has been harmed by my drinking.	0	1	2	3
37. Because of my drinking, I have not had the kind of life that I want.	0	1	2	3
38. My drinking has gotten in the way of my growth as a person.	0	1	2	3
39. My drinking has damaged my social life, popularity, or reputation.	0	1	2	3
40. I have spent too much or lost a lot of money because of my drinking.	0	1	2	3

Please continue on the next page

Now please indicate whether these things have happened to you *DURING THE PAST 3 MONTHS.*

Has this happened to you *DURING THE PAST 3 MONTHS*? **Circle one answer for each item:**	No	Almost	Yes, Once	Yes, More than Once
41. I have been arrested for driving under the influence of alcohol.	0	1	2	3
42. I have had trouble with the law (other than driving while intoxicated) because of my drinking.	0	1	2	3
43. I have lost a marriage or a close love relationship because of my drinking.	0	1	2	3
44. I have been suspended/fired from or left a job or school because of my drinking.	0	1	2	3
45. I drank alcohol normally, without any problems.	0	1	2	3
46. I have lost a friend because of my drinking.	0	1	2	3
47. I have had an accident while drinking or intoxicated.	0	1	2	3
48. While drinking or intoxicated, I have been physically hurt, injured, or burned.	0	1	2	3
49. While drinking or intoxicated, I have injured someone else.	0	1	2	3
50. I have broken things while drinking or intoxicated.	0	1	2	3

Appendix E

IMPORTANT PEOPLE INTERVIEW

Modified for Participant Use
(Longabaugh & Zywiak)

For this questionnaire, you will be asked some questions about ___________. Please think about your contact with ____________ over the last six months only. If you have any questions at any point during this questionnaire, please don't hesitate to ask the research assistant.

1. Please specify your relationship with this person:

1 = parent	6 = other relative
2 = spouse	7 = friend
3 = significant other	8 = co-worker
4 = child	9 = other: ________
5 = sibling	

2. How important has this person been to you?

6 = extremely important	3 = somewhat important
5 = very important	2 = not very important
4 = important	1 = not at all important

3. To what extent is this person generally supportive of you? (…*by being sensitive to your personal needs, helping you to think about things and solve problems, and by giving you the moral support you need?)*

6 = extremely supportive	3 = somewhat supportive
5 = very supportive	2 = not very supportive
4 = supportive	1 = not at all supportive

4. How has (or would) this person reacted to your drinking?

5 = encouraged	2 = didn't accept
4 = accepted	1 = left, or made you leave when you're drinking
3 = neutral	

5. How has (or would) this person reacted to your <u>not</u> drinking?

5 = encouraged	2 = didn't accept
4 = accepted	1 = left, or made you leave when you're not drinking
3 = neutral	

6. How does (or would) this person feel about your getting alcohol treatment?

6 = would strongly support it
5 = would support it
4 = neutral
3 = mixed
2 = would oppose it
1 = would strongly oppose it

7. How often do you drink with this person?

1. Every day or nearly every day
2. 3-4 times a week
3. 1-2 times a week
4. 1-3 times a month
5. 7-11 times in past six months
6. Twice in past six months
7. Once in past six months

Appendix F

IMPORTANT PEOPLE INTERVIEW

Modified for SO Use
(Longabaugh & Zywiak)

For this questionnaire, you will be asked some questions about _____________. Please think about your contact with ______________ over the last six months only. If you have any questions at any point during this questionnaire, please don't hesitate to ask the research assistant.

8. Please specify your relationship with this person:

1 = parent	6 = other relative
2 = spouse	7 = friend
3 = significant other	8 = co-worker
4 = child	9 = other: _________
5 = sibling	

9. How important has this person been to you?

6 = extremely important	3 = somewhat important
5 = very important	2 = not very important
4 = important	

10. To what extent are you generally supportive of this person? (*…by being sensitive to his/her personal needs, helping him/her to think about things and solve problems, and by giving him/her the moral support he/she needs?)*

6 = extremely supportive	3 = somewhat supportive
5 = very supportive	2 = not very supportive
4 = supportive	1 = not at all supportive

11. How have (or would) you reacted to this person's drinking?

5 = encouraged	2 = didn't accept
4 = accepted	1 = left, or made him/her leave when he/she's drinking
3 = neutral	

12. How have (or would) you reacted to this person's <u>not</u> drinking?

5 = encouraged	2 = didn't accept
4 = accepted	1 = left, or made him/her leave when he/she's not drinking
3 = neutral	

13. How do (or would) you feel about this person getting alcohol treatment?

6 = would strongly support it	3 = mixed
5 = would support it	2 = would oppose it
4 = neutral	1 = would strongly oppose it

14. How often do you drink with this person?

1. Every day or nearly every day
2. 3-4 times a week
3. 1-2 times a week
4. 1-3 times a month
5. 7-11 times in past six months
6. Twice in past six months
7. Once in past six months

Appendix G

Timeline Followback

****Instructions:** On the following page is a calendar for the last three months. Fill in the number of alcoholic drinks (A = # of drinks) had on each day over the past three months. Use of a daily planner or anything else that may help participant remember when and how much alcohol was consumed is encouraged. If the exact amount is not known, take the best guess and ESTIMATE.

1 Standard Drink is Equal to

One 12 oz can/bottle of beer

One 5 oz glass of regular (12%) wine

1 ½ oz of hard liquor (e.g. rum, vodka, whiskey)

1 mixed or straight drink with 1 ½ oz hard liquor

Complete the Following

Start Date (Day 1): ______________________________ **End Date** (yesterday): ______________________________

MO DY YR MO DY YR

Total Number of Calendar Days ____________________

Number of Drinks ____________________

Number of Drinking Days ____________________

Number of Heavy Drinking Days ____________________

Max Number of Drinks ____________________

Number of Non-Drinking Days ____(calculate in database)____

Average # of Drinks per Drinking Day ____(calculate in database)____

*__make sure to use standard drinks__

Appendix H

Graduated Frequency Measure

(Clark & Midanik, 1982)

"I'd like you to think about your drinking over the past year. Please think of **all** kinds of alcoholic beverages **combined**, that is, any combination of cans of beer, glasses of wine, or drinks containing liquor of any kind. A single drink is defined as 12-oz of beer, 4-oz of wine, or 1.5-oz of liquor (i.e. one shot). During the last 12 months, what is the largest number of drinks you had on any single day?" __________ (*Write answer here*)

A. If drank 12 or more drinks on a single day, "how many times during the past 12 months did you drink 12 or more drinks in a single day?"

1. Every day or nearly every day
2. 3-4 times a week
3. 1-2 times a week
4. 1-3 times a month
5. 7-11 times in the past year
6. 3-6 times in the past year
7. Twice in the past year
8. Once in the past year

B. If drank 8-11 drinks on a single day, "how many times during the past 12 months did you drink at least 8 but no more than 11 drinks in a single day?"

1. Every day or nearly every day
2. 3-4 times a week
3. 1-2 times a week
4. 1-3 times a month
5. 7-11 times in the past year
6. 3-6 times in the past year
7. Twice in the past year
8. Once in the past year

C. If drank 5-7 drinks on a single day, "how many times during the past 12 months did you drink at least 5 but no more than 7 drinks in a single day?"

1. Every day or nearly every day
2. 3-4 times a week
3. 1-2 times a week
4. 1-3 times a month
5. 7-11 times in the past year
6. 3-6 times in the past year
7. Twice in the past year
8. Once in the past year

D. If drank 3-4 drinks on a single day, "how many times during the past 12 months did you drink at least 3 but no more than 4 drinks in a single day?"

1. Every day or nearly every day
2. 3-4 times a week
3. 1-2 times a week
4. 1-3 times a month
5. 7-11 times in the past year
6. 3-6 times in the past year
7. Twice in the past year
8. Once in the past year

E. If drank 1-2 drinks on a single day, “how many times during the past 12 months did you drink at least 1 but no more than 2 drinks in a single day?”

1. Every day or nearly every day
2. 3-4 times a week
3. 1-2 times a week
4. 1-3 times a month
5. 7-11 times in the past year
6. 3-6 times in the past year
7. Twice in the past year
8. Once in the past year