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## Covariates of Craving in Actively Drinking Alcoholics

Subhajit Chakravorty, MD<sup>1,2,3</sup>, Samuel T. Kuna, MD<sup>2,4</sup>, Nikola Zaharakis, BA<sup>5</sup>, Charles P. O'Brien, MD, PhD<sup>1,3</sup>, Kyle M. Kampman, MD<sup>3</sup>, and David Oslin, MD<sup>1,3,6</sup>

<sup>1</sup> Veterans Integrated Service Network, Mental Illness Research, Education and Clinical Center, Philadelphia V.A. Medical Center, Philadelphia, Pennsylvania

<sup>2</sup> Center for Sleep and Respiratory Neurobiology, University of Pennsylvania, Philadelphia, Pennsylvania

<sup>3</sup> Treatment Research Center-Center for Study on Addictions, University of Pennsylvania, Philadelphia, Pennsylvania

<sup>4</sup> Pulmonary, Critical Care and Sleep Section, Philadelphia V.A. Medical Center, Philadelphia, Pennsylvania

<sup>5</sup> Department of Psychology, Virginia Commonwealth University, Richmond, Virginia

<sup>6</sup> Section of Geriatric Psychiatry, university of Pennsylvania, Philadelphia, Pennsylvania

### Abstract

The goal of this cross-sectional study was to assess the relationship of alcohol craving with biopsychosocial and addiction factors that are clinically pertinent to alcoholism treatment. Alcohol craving was assessed in 315 treatment-seeking, alcohol dependent subjects using the PACS questionnaire. Standard validated questionnaires were used to evaluate a variety of biological, addiction, psychological, psychiatric, and social factors. Individual covariates of craving included age, race, problematic consequences of drinking, heavy drinking, motivation for change, mood disturbance, sleep problems, and social supports. In a multivariate analysis ( $R^2 = .34$ ), alcohol craving was positively associated with mood disturbance, heavy drinking, readiness for change, and negatively associated with age. The results from this study suggest that alcohol craving is a complex phenomenon influenced by multiple factors.

### Introduction

Reward mechanisms and craving have been identified as important aspects of alcoholism. Craving, or the urge to use alcohol, is present in 54% to 72% of alcohol dependent subjects.<sup>1-2</sup> The importance of alcohol craving especially at the onset of treatment is underscored by its association with relapse throughout the first 12 months of recovery.<sup>3-6</sup> Despite this commonality of craving and its associated clinical importance, there is however no consensus on the definition of craving, the clinical factors that influence craving, or the optimal assessment measure for craving.<sup>7</sup> In order to understand the construct of craving better, previous research has examined specific clinical factors associated with craving.

In principle, treatment of alcohol dependence, similar to other psychiatric treatments, utilizes the biopsychosocial model, which consists of biological, psychological, psychiatric

Address correspondence to Dr. Chakravorty, MIRECC VISN 4, Philadelphia V.A. Medical Center, University & Woodland Avenues, Philadelphia, PA 19104., Subhajit.Chakravorty@uphs.upenn.edu.

#### Declaration of Interest

The authors report no conflict of interest. The authors alone are responsible for the content and writing of the paper.

and social factors. In the *Biological* component, gender differences in craving have been seen in female subjects (in comparison to male subjects), showing, a higher alcohol urge reactivity in response to negative mood states,<sup>8</sup> and a positive association of alcohol craving with serum leptin levels at the onset of treatment.<sup>9</sup> A family history of alcohol dependence has been associated with higher craving.<sup>10,11</sup> In the *Addiction* component, alcohol craving has been positively associated with the severity of alcohol dependence, a history of recurrent detoxifications,<sup>1,12</sup> and nicotine dependence.<sup>13</sup> In the *Psychological/Psychiatric* component, psychological and psychophysiological aspects of alcohol craving have been extensively evaluated (see reviews<sup>14,15</sup>). Alcohol craving has been shown to be positively associated with a negative mood state or stress,<sup>16,17</sup> and an increased anxiety level and a novelty-seeking temperament.<sup>18</sup>

There are, however, other variables in the biopsychosocial addiction model that are important to addiction treatment and whose relationship with craving is currently unknown. For instance, in the *Biological* component, age and craving have been indirectly associated through their relationship with dopamine.<sup>19–22</sup> The racial difference in craving is incompletely understood currently. With regards to race, there is a lower prevalence in most African Americans of the Asp40 allele of the  $\mu$ -opioid receptor gene; this gene has been shown to be associated with euphoria or craving in response to alcohol<sup>23</sup> and effectiveness of naltrexone treatment.<sup>10,24</sup> In the *Addiction* component, the problematic consequence of a subject's alcohol use has been clinically seen to have a variable relationship with craving. The problematic consequence may increase the urge to use alcohol in some patients, whereas in others it helps to desist from alcohol use. In the *Psychological* component, motivation for change, a clinically pertinent treatment variable, may be a product of a conflict between drinking urges versus ambivalence and coping,<sup>25,26</sup> thereby encouraging entry into treatment. In the *Psychiatric* component, sleep abnormalities specifically insomnia, are highly prevalent in alcohol dependent subjects and may predict relapse after treatment.<sup>27,28</sup> In the *Social* component, higher levels of social supports have predicted reductions in alcohol use during treatment, whereas lower levels of social supports have predicted dropout from treatment.<sup>29</sup> In addition, social supports have been shown to negatively moderate the association between incidences of stressors and craving in subjects with addictions.<sup>30</sup> In summary, the relationship of craving with different variables in the biopsychosocial and addiction components, including, age, race, problematic consequences of alcohol use, motivation for change, sleep disturbance and social support, are currently unknown.

In this current study we evaluated the association between alcohol cravings and several new variables as well as previously investigated variables in the biopsychosocial addiction models. Specifically, we assessed the relationship of alcohol craving with the following factors: (1) Biological – age, gender, race, and a family history of alcohol dependence in first degree relatives (2) Addiction – problematic consequences from drinking, proportion of days of heavy drinking over the last 90 days, and nicotine dependence (3) Psychological/Psychiatric – motivation for change, mood disturbance, and sleep disturbance, and (4) Social – subjective social supports. Our hypothesis included the following: (1) alcohol craving would be positively associated with female gender, a family history of alcoholism in first degree relatives, proportion of days of heavy drinking, problematic consequences of drinking, nicotine dependence, motivation for change, mood disturbance and sleep problems (2) alcohol craving would be greater in the Caucasian subjects as compared to the African American subjects and (3) alcohol craving would be inversely associated with age and the presence of subjective social supports.

## Materials and Methods

### Design

This cross-sectional study analyzed data obtained during the baseline assessment of subjects enrolled in the “Extending the Treatment Efficacy of Naltrexone” (ExTEND) trial (N = 315), regardless of whether or not they were subsequently randomized into that clinical trial. The study was conducted at the University of Pennsylvania Medical Center and the Philadelphia Veterans Affairs Medical Center (PVAMC).

### Study

The aim of the study was to define the response to naltrexone and determine the appropriate clinical algorithm for responders and non-responders to treatment. The study participants were recruited through advertisements in the local media or from the clinical services at the Philadelphia VA Medical Center. The study was reviewed and approved by the Institutional Review Boards of the University of Pennsylvania and the Philadelphia VA Medical Center with all participants providing written informed consent prior to study participation.

### Inclusion Criteria

Participants were 18 years of age or older, had a current DSM IV diagnosis of alcohol dependence and were able to comprehend and converse in English. They were required to have been drinking within 30 days of randomization into the study and report a minimum consumption of 48 standard alcoholic drinks in a consecutive 30-day period prior to being recruited, and have at least 2 or more days of heavy drinking (defined as over 5 drinks in males and 4 drinks in females) in the 30-day period prior to recruitment.

### Exclusion Criteria

Individuals were excluded from the study if they met any of the following criteria: dependence on any substance with the exception of alcohol, nicotine and marijuana, as defined by the DSM IV criteria; a lifetime history of any significant psychiatric diagnosis (e.g. bipolar disorder, schizophrenia or any psychotic disorder); evidence of a significant medical illness (hepatic/hematological/pulmonary/endocrine/cardiovascular/renal or gastrointestinal disease); use of a psychotropic medication (including diphenhydramine and disulfiram) regularly within seven days prior to recruitment; current risk of becoming pregnant or currently pregnant.

### Measures

**Structured Clinical Interview for Diagnosis of DSM IV Disorders (SCID)**—The SCID-1 was used to establish the diagnosis of alcohol dependence.<sup>31</sup>

**Mini International Neuropsychiatric Interview (MINI)**—The MINI version 5.0.0 was also used to verify the diagnosis of alcohol dependence, as well as to assess for any manic or hypomanic episode, panic disorder, PTSD, GAD and psychotic disorder.<sup>32</sup>

**Penn Alcohol Craving Scale (PACS)**—The PACS, a 5-item scale assessing for craving over the last seven days, was used to assess for alcohol craving in the subjects. Item scores range from 0–6 in increasing order of severity, with a total PACS score ranging from 0–30. The PACS possesses good psychometric properties (Cronbach’s  $\alpha = 0.92$ ).<sup>33</sup> We will use the term craving in this manuscript to denote “urge to use alcohol” or “the desire to drink.”

**Duke Social Support Index (DSSI)**—The DSSI yields 4 subscales, namely subjective support, social network, social interaction, and instrumental support. The subjective support

subscale, a distinct entity that measures support from family and friends, is inversely related to mental distress and is perhaps the most important dimension related to health outcomes.

34 We used the subjective support subscale of the DSSI to assess for social support.

**Short Index of Problems (SIP)**—The SIP is a 15-item questionnaire that assesses for the severity of alcohol dependence across five alcohol related problem areas over the past 3 months (recent) and lifetime. The total SIP score has good internal consistency (Cronbach's  $\alpha = 0.79$ ) and test-retest correlation of 0.74.<sup>35</sup>

**Time Line Follow Back (TLFB)**—The TLFB was used to record the quantity and frequency of drinking during the 90 days prior to entry into the study.<sup>36</sup> The drinking variable of interest was the number of heavy drinking days ( $\geq 5$  standard drinks per day in males and  $\geq 4$  standard drinks per day in females). The proportion of days of heavy drinking (PDHD) was estimated as the fraction of days of heavy drinking to the total number of drinking days.<sup>37</sup>

**Fagerstrom's Test for Nicotine Dependence (FTND)**—The FTND is a 6-item measure to assess for nicotine dependence with a total score range of 0–10.<sup>38</sup>

**University of Rhode Island Change Assessment Scale (URICA)**—The URICA, a 32-item self report inventory, assesses motivation for change.<sup>39</sup> Several studies that included alcoholics report good internal consistency of the 4 subscales.<sup>40</sup> The composite measure, Readiness for Change, is obtained by summing the totals on the Contemplation, Action and Maintenance subscales and then subtracting the score on the Pre-contemplation subscale; this measure has shown good concurrent validity with baseline characteristics and change process variables.<sup>41</sup>

**Profile of Mood States-Short Form (POMS-SF)**—This 37-item scale was developed to assess transient, distinct mood states with 6 subscales and a global distress score, Total Mood Disturbance.<sup>42</sup> The internal consistency (Cronbach's  $\alpha$ ) for the subscales range from 0.76 – 0.95 and from 0.87 – 0.90 for the Total Mood Disturbance.<sup>43</sup>

**Medical Outcomes Study Sleep Scale (MOS Sleep Scale)**—This validated 12-item self report sleep measure assesses the different dimensions of subjective sleep.<sup>44</sup> This scale has 4 subscales which include (mean  $\pm$  SD, of the reference group published by the authors): sleep disturbance (initial and middle insomnia and “sleep not quiet”,  $29.20 \pm 23.37$ ), quantity of sleep (duration of sleep at night,  $6.93 \pm 1.40$  hours), sleep adequacy (amount of sleep to feel well rested upon waking in the morning  $60.67 \pm 25.38$ ) and daytime somnolence (daytime drowsiness and taking naps,  $26.41 \pm 19.82$ ). Higher values on the sleep disturbance and daytime somnolence denote bigger problems, whereas a lower number on the sleep adequacy scale denotes a bigger problem. This scale also generates a global score, known as the Sleep Problems Index (SPI) (9 items,  $29.15 \pm 18.04$ ), which has been shown to have the strongest correlations with health measures. The central tendency (standard deviation) for the total sleep duration is  $6.93 \pm 1.40$  hours.<sup>45</sup> The internal consistencies ( $\alpha$ ) of the sleep disturbance, daytime somnolence, and SPI scales range from 0.63 – 0.82; that for sleep adequacy ranges from 0.63 – 0.73. The reliability coefficients of these scales range from 0.75 to 0.86.<sup>45</sup>

**Family Informant Schedule and criteria (FISC)**—The FISC is designed to assess family history of psychopathology and psycho-active substance use disorders in first- and second-degree relatives.<sup>46</sup>

## Statistical Analysis

The tests of significance included the independent sample t-tests (craving in males and females, craving in Caucasian and African American subjects, first-degree family history of alcohol dependence versus other family history). Correlation analyses using bivariate correlations (Pearson's correlation coefficient) were used to assess for correlation between pairs of variables prior to conducting univariate analysis. Univariate analyses to assess for covariates of craving were conducted using linear regression analyses with the total craving score as the dependent variable. Independent variables were comprised of demographics (age, gender, race), subjects with family history of first-degree relatives, Subjective Support-DSSI score, SIP-recent total score, drinking scales derived from the TLFB, FTND, URICA scale scores, POMS-SF scale scores, and the MOS Sleep Scale subscales. Summary scores for the different scales were used wherever indicated (i.e. SIP-Recent total score, Proportion of Days of Heavy Drinking, Total FTND score, Readiness Scale score from the URICA scale,<sup>41</sup> Total Mood Disturbance from the POMS-SF,<sup>42,43</sup> and Sleep Problems Index from the MOS Sleep Scale<sup>44</sup>). A Bonferroni correction with  $p = .035$  was applied for the multiple comparisons. A multivariate analysis was conducted using a backward regression model simultaneously entering all the significant variables from the univariate analyses, which included the following: mood disturbance, PDHD, readiness for change, age, subjective social support, race, sleep disturbance, and SIP-recent. Since the current analysis is a preliminary analysis of multiple new variables, as well as some previously investigated variables,<sup>1,5,16,21</sup> all the variables were therefore simultaneously entered into the final multivariate model.

The SIP-recent and the PDHD assess for the severity of alcohol addiction; however, minimal collinearity exists between these two variables since they assess for different aspects of alcoholism (quality and quantity of alcohol dependence, respectively). Both variables were significant covariates of craving, hence were simultaneously entered into the final multivariate model. Mood disturbance and sleep problems represent different domains of psychiatric variables and exhibit minimal co-linearity. Since sleep has not been assessed for its relationship with craving but was individually seen to be a significant covariate, the global sleep score was also entered into the final model.

## Results

### Subjects and Demographics

The majority of our subjects were middle-aged, male, Caucasian, and non-Hispanic, with more than 12 years of education. One-third of the subjects had a first-degree relative with alcohol dependence (see Table 1). Most of the subjects were married, living with at least one other person, and employed within the last 30 days. Six (2.1 %) of the subjects reported no craving. The mean craving score was  $15.69 \pm 7.16$  (range of 0–30).

### Association between Craving and Study Variables

**Biological Variables**—The age of the subjects was significantly and inversely associated with craving ( $p = .001$ ), (see Table 2). Caucasian subjects had significantly higher craving  $16.61 \pm 6.78$  (mean  $\pm$  S.D.) as compared to the African American subjects  $13.62 \pm 7.46$   $p = .003$ . Univariate analyses showed that race was significantly associated with craving even after controlling for potential moderating variables of education and income ( $p = .001$ ). No difference in the craving between male and female subjects was seen. A family history of alcoholism in the first degree relatives was not associated with craving (see Table 2).

**Addiction Variables**—The SIP-total score (SIP-recent, over the past 3 months) and SIP-lifetime total score were significantly associated with craving ( $p < .001$ ). The SIP-recent total

score was also positively associated with proportion of days of heavy drinking ( $r = .22$ ,  $p = .001$ ), readiness ( $r = .29$ ,  $p < .001$ ) and mood disturbance ( $r = .58$ ,  $p < .001$ ), and negatively associated with age ( $r = -.23$ ,  $p < .001$ ).

Subjects drank  $11 \pm 6$  standard drinks per day, with the proportion of heavy drinking days predominating over the last ninety days at  $68 \pm 29\%$ . All the drinking variables were positively associated with craving. A trend towards a relationship between nicotine dependence and alcohol craving was also seen ( $p = .07$ ) (see Table 2).

**Psychological Variables**—As expected in these treatment-seeking subjects, their stages of change profile showed higher scores in stages of contemplation, action, and readiness for change scales (see Table 2). The readiness for change scale was significantly and positively associated with craving. Additionally, the readiness for change scale was positively associated with SIP – total lifetime ( $r = .26$ ,  $p < .001$ ) and SIP – total recent ( $r = .29$ ,  $p < .001$ ).

### Psychiatric Variables

**Mood:** The five negative mood state subscales and the global distress score from the POMS-SF showed increased mean scores, in comparison to the initial data for the POMS-SF<sub>42</sub> (see Table 2). All of the mood scales were significantly associated with craving. An interaction analysis of mood disturbance and subjective social support did not show a significant relationship with craving.

**Sleep:** Comparing the mean score of our subjects to the normative data,<sup>45</sup> our subjects showed a decreased mean subjective total sleep time [ $6.07 \pm 1.54$  hours], increased sleep disturbance scale score [ $44.06 \pm 26.67$ ], decreased sleep adequacy scale score [ $48.82 \pm 27.17$ ], increased somnolence [ $27.45 \pm 20.50$ ], and increased sleep problems index [ $39.26 \pm 19.78$ ] (see Table 2). All the sleep scales were significantly associated with craving (see Table 2). An association between the mood and sleep scales was seen on correlation analysis ( $r$ -values ranging from 0.36–0.46, with all  $p < .001$ ).

**Social Variables**—Better social support was associated with more craving ( $p = .002$ ). There was a significant correlation between social support and mood disturbance ( $r = .34$ ,  $p = < .001$ ); however, no correlation existed between social support and readiness for change (motivation). Thus social support was positively associated with craving and mood disturbance, however as mentioned above, there was no interaction of mood disturbance and social support with craving.

**Multivariate Analysis**—In the multivariate analysis (see Table 3), craving was significantly associated with the proportion of days of heavy drinking, total mood disturbance, the readiness for change scale and the subject's age. This model explained 34% of the variance of the craving. The variables that were not seen to be significant in the final model included: race, subjective social support, SIP-recent, and sleep problems.

## Discussion

Prior craving studies have reported the individual relationship of alcohol craving with gender, family history, social support, intensity of alcohol dependence, nicotine dependence as well as stress or mood state. In this cross-sectional study of actively drinking alcohol dependent subjects, we evaluated several novel covariates and re-evaluated some previously investigated covariates of craving. Unique covariates of alcohol craving found in this study included the following: race, subjective social support, problematic consequences of alcohol



use, motivation for change, and sleep complaints. Alcohol craving was negatively associated with age. Craving was also positively associated with alcohol use, and mood disturbance. In a multivariate analysis, 34 % of the variance of alcohol craving was predicted positively by heavy drinking, mood disturbance and motivation for change; alcohol craving was negatively predicted by age.

These results support the individual association of most of the variables with craving, as we had hypothesized, with the exception of gender, family history of alcohol dependence and nicotine dependence. The lack of an association of gender and family history of alcohol dependence with craving may be due to sample characteristics; specifically, the relatively low number of female subjects, and most of our subjects lacking a family history of alcohol dependence in the first degree relatives. Similarly, the low level of nicotine dependence may have accounted for the lack of association of nicotine dependence with alcohol craving.

Age was inversely associated with craving in our subjects. This finding may help account for the better prognosis for older adults in alcoholism treatment.<sup>47</sup> The increased craving in our Caucasian subjects may be associated with the racial differences in the efficacy of the drug, naltrexone, a mu-opioid receptor antagonist medication that decreases craving. The greater efficacy of naltrexone in Caucasian than African-American subjects has been related to the underlying higher prevalence of the genetic polymorphism of the Asp40 allele of the mu-opioid receptor 1 gene in Caucasians.<sup>10</sup> In our study, social support was independently associated with craving. This finding may be possibly due to our actively drinking alcohol dependent subjects being in the company of others, who are also actively involved with drinking. Social supports was however, neither a predictor in the final model, nor seen to moderate the relationship of mood and craving in our subjects, as reported in previous studies.<sup>30-48</sup>

The proportion of heavy drinking days prior to entering treatment, a sign of severity of alcohol dependence, was significantly and positively associated with craving, as previously reported.<sup>1-12</sup> Alcohol craving was associated with the problematic consequences of alcohol use, through its relationships with mood disturbance, heavy drinking, and motivation for change. Thus the increased craving secondary to psychosocial consequences after prolonged drinking may compel the alcohol dependent patients to seek treatment.

Motivation for change was positively associated with craving, another unique finding in this study. Motivation for change has previously been associated with decreased drinking at entry into the study,<sup>49</sup> and with decreased post-treatment drinking after one year.<sup>50</sup> Once drinking resumes, however, factors other than stages of change appear to be associated with the drinking.<sup>51</sup> Using the construct of self efficacy,<sup>52</sup> we may speculate that high craving state is associated with distress in these participants. This high craving may thus be associated with an increased motivation to seek change or treatment.

The subjects also reported symptoms of mood disturbance, that was individually associated with craving as has been shown before.<sup>17-53-54</sup> Consistent with prior literature, our actively drinking subjects reported sleep complaints in the domain of insomnia.<sup>55</sup> The individual relationship of sleep problems with craving, is another novel finding in this study. The variance of sleep abnormalities, however, was explained by the underlying mood disturbance, consistent with previous literature.<sup>56</sup> Intensified sleep problems and REM sleep abnormalities have been reported in subjects with secondary depressive disorder.<sup>28-57</sup> Treatment of insomnia in recovering alcoholics may therefore be considered a therapeutic target for the treatment of the mood symptoms and craving, and thus the underlying alcohol dependence.

The relationship between craving and these multiple variables in the final model may have an underlying neuro-anatomic basis. Alcohol craving have been associated with brain activity in the nucleus accumbens, anterior cingulate cortex, orbitofrontal cortex, and the limbic system.<sup>58-59</sup> Neuro-anatomical correlates of sleep disturbance in depressed subjects have included cingulate cortex, insula, limbic system and basal ganglia.<sup>60</sup> Reasoning and informed decisions have been associated with the prefrontal and cingulate cortex<sup>61</sup> and the posterior cingulate and the hippocampus<sup>62</sup> respectively. In summary, the areas of prefrontal cortex, orbitofrontal cortex, limbic system and basal ganglia may be crucial to the understanding of the underlying interrelationship of motivation and mood disturbance, and craving in alcoholics.

The limitations of this study were threefold. First, this was a convenience sample of treatment-seeking subjects and may not be representative of all alcohol dependent subjects. Second, the study was cross-sectional in nature; therefore the temporal relationship of alcohol craving with the other variables could not be elicited. Third, this study lacked the broad inclusion of certain minority populations (including Asians and Native Americans). Longitudinal studies will be necessary to clarify the relationships between craving and motivation for change, and, the interplay of different variables including social support and sleep problems with mood disorders and craving. These relationships may have important implications for integrated treatment planning in alcohol dependence.

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**Table 1**

## Baseline demographics

Characteristic	
Age Mean $\pm$ SD	48.3 $\pm$ 10.4
Education – number of years Mean $\pm$ SD	14.1 $\pm$ 2.5
Gender – male % (n)	87 (269)
<b>Race:</b> % (n)	
White	65.8 (202)
Black	30.6 (94)
Others*	3.6 (11)
<b>Ethnicity:</b> % (n)	
Hispanic	2.6 (8)
<b>Family History:</b> % (n)	
Alcoholism in All Relatives	20.5 (44)
Alcoholism in First Degree Relatives	34.4 (74)
<b>Marital status:</b> % (n)	
Married	47.8 (144)
Divorced or separated	26.5 (80)
Never married	23.9 (72)
Widowed	1.7 (5)
<b>Living Situation:</b> % (n)	
Living with partner & children	34.7 (104)
Living with partner alone	23.7 (71)
Living alone	19.7 (59)
Living with parents/family	13.0 (39)
Others†	9.0 (27)
<b>Income (in \$ over past month):</b>	
Employment	2391 $\pm$ 2923
Pension/Social Security	203 $\pm$ 699
Friends/Family	158 $\pm$ 921
Unemployment Compensation	56 $\pm$ 275

\* = Other Races (4 Asian and 7 Native American subjects)

† = Other Living Situation (included 12 subjects living with children only, 11 subjects living with friends, 3 subjects had no stable arrangements, and 1 subject was living in a controlled environment)

**Table 2**

Univariate Analysis (Linear Regression) of Craving with Biological, Addiction, Psychological, Psychiatric and Social Variables

Domain	Measure	Mean $\pm$ S.D.	R <sup>2</sup>	p
<b>Craving Biological</b>	Total PACS * Score	15.69 $\pm$ 7.16		
	Age	48.31 $\pm$ 10.37	.03	<b>.001</b>
	<b>Gender (craving score)<sup>†</sup>:</b>		.002	.20
	Male	15.91 $\pm$ 7.21		
	Female	14.35 $\pm$ 6.72		
	<b>Race (craving score)<sup>†</sup>:</b>		.06	<b>.001</b>
	Caucasian	16.61 $\pm$ 6.78		
	African American	13.62 $\pm$ 7.46		
	Family History in 1 Relatives <sup>§</sup>	16.24 $\pm$ 6.35	0	.31
<b>Addiction (Alcohol)</b>	SIP// – Recent	18.93 $\pm$ 11.39	.18	<b>&lt;.001</b>
	SIP – Lifetime	10.66 $\pm$ 3.70	.15	<b>&lt;.001</b>
	Drinks/Drinking Day	11 $\pm$ 6	.02	<b>.007</b>
	Proportion Days Drinking (%)	79 $\pm$ 22	.03	<b>.003</b>
	PDHD <sup>¶</sup> (%)	68 $\pm$ 29	.06	<b>&lt;.001</b>
	GGT <sup>#</sup>	111.2 $\pm$ 178.2	.01	.045
<b>(Nicotine) Psychological (URICA<sup>††</sup>)</b>	<b>Nicotine: Total FTND ** Score</b>	1.85 $\pm$ 2.73	.008	.076
	Precontemplation	14.17 $\pm$ 4.45	.10	<b>&lt;.001</b>
	Contemplation	33.74 $\pm$ 4.23	.01	.072
	Action	33.62 $\pm$ 4.52	.002	.238
	Readiness for Change	81.34 $\pm$ 13.29	.06	<b>&lt;.001</b>
<b>Psychiatric:</b>	<b>Mood:</b>			
	Confusion - Bewilderment	5.55 $\pm$ 4.26	.14	<b>&lt;.001</b>
	Fatigue-Inertia	7.64 $\pm$ 5.39	.13	<b>&lt;.001</b>
	Anger-Hostility	7.79 $\pm$ 6.42	.14	<b>&lt;.001</b>
	Tension-Anxiety	9.30 $\pm$ 6.25	.20	<b>&lt;.001</b>
	Depressed-Dejected	9.31 $\pm$ 7.98	.18	<b>&lt;.001</b>
	Total Mood Disturbance	39.61 $\pm$ 26.42	.22	<b>&lt;.001</b>
	<b>Sleep:</b>			
	Total Sleep Duration	6.07 $\pm$ 1.54	.01	<b>.017</b>
	Sleep Disturbance Scale	44.06 $\pm$ 26.67	.03	<b>.001</b>
	Sleep Adequacy Scale	48.82 $\pm$ 27.17	.09	<b>&lt;.001</b>
	Somnolence Scale	27.45 $\pm$ 20.50	.02	<b>.007</b>
	Sleep Problems Index Scale	39.26 $\pm$ 19.78	.07	<b>&lt;.001</b>
<b>Social (DSSI10)</b>	Subjective Social Support	11.34 $\pm$ 2.46	.03	<b>.002</b>

\* = Penn Alcohol Craving Scale

<sup>†</sup> = p value not significant

$\ddagger$  = Caucasian versus African Americans, controlled for education and income

$\S$  = First degree relatives as compared to other relatives with a history of alcohol dependence

// = Short Index of Problems

$\P$  = Proportion of Days of Heavy Drinking

# = Gamma Glutamyl Transferase (IU/L)

\*\* = Fagerstrom's Test for Nicotine Dependence

$\dagger\dagger$  = University of Rhode Island Change Assessment Scale 10 = Duke's Social Support Index



**Table 3**

Multivariate Model of Predictors of Alcohol Craving

Variable	B*	SE $\beta^{\dagger}$	$\beta^{\ddagger}$	t $^{\S}$	p	R <sup>2</sup>	p
Mood Dist.//	.12	.01	.47	8.45	<.001	.34	<.001
PDHD $\P$	4.71	1.30	.2	3.61	<.001		
Readiness $^{\#}$	.07	.02	.14	2.61	.009		
Age	-.08	.03	-.11	-2.10	.03		

\* = Unstandardized  $\beta$  $\dagger$  = Standard Error of b $\ddagger$  = Standardized  $\beta$  $\S$  = t score

// = Total Mood Disturbance

 $\P$  = Proportion of Days of Heavy Drinking $^{\#}$  = Readiness for Change