

Sensation Seeking in Long-Term Abstinent Alcoholics, Treatment-Naïve Active Alcoholics, and Nonalcoholic Controls

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Background: Elevated sensation seeking is associated with the development of alcohol dependence; however, it has not been studied in long-term abstinent alcoholics. In the current study, we examine sensation seeking in middle-aged long-term abstinent alcoholics (LTAA) and in younger actively drinking treatment-naïve alcoholics (TxN).

Methods: A modified version of the Sensation Seeking Scale (SSS) was administered to 52 middle-aged LTAA (average age = 46.6 years) and 86 younger TxN (average age = 31.2 years), each study with its own age and gender comparable nonalcoholic controls (NAC). The SSS was modified to remove items specifically associated with alcohol or drug use. The associations between the SSS and alcohol use and deviance proneness were examined.

Results: The 2 NAC samples did not differ on the SSS, allowing the 2 NAC samples to be combined into a single control group (NAC = 118), and the LTAA and TxN samples to be directly compared without concern for cohort effects. LTAA did not differ from NAC on the SSS; however, the TxN group had higher SSS scores compared with NAC on all subscales except Boredom Susceptibility. Sensation seeking was comparably associated with lower socialization in each group.

Conclusions: The results suggest that either sensation seeking normalizes with long-term abstinence or that relatively normal levels of sensation seeking predict the ability to achieve long-term abstinence. In either case, the results have important implications for our understanding of long-term abstinence.

Key Words: Alcoholism, Long-Term Abstinence, Sensation Seeking, Personality.

ONE OF THE personality traits associated with high levels of alcohol and drug use is high sensation seeking (Andrucci et al., 1989; Conrod et al., 2008; Croissant et al., 2008). Sensation seeking is defined as a strong need for varied, novel, and stimulating experiences, and willingness to take risks for the sake of such experiences (Zuckerman, 1979). Earleywine and Finn (1991) presented evidence that the association between behavioral disinhibition, alcohol-related problems, and drinking habits may be a product of their inter-relations with sensation seeking. There have been a plethora of studies of adolescents and young adults showing that high sensation seeking is a strong predictor of higher levels of alcohol and drug use, and of the development of later alcohol problems, including alcohol abuse and dependence

(Andrucci et al., 1989; Conrod et al., 2008; Croissant et al., 2008; Finn et al., 1992; Hesselbrock and Hesselbrock, 1992).

Studies of personality and alcohol use/abuse suggest that there are 2 personality-related pathways to early-onset alcohol abuse: (i) a sensation seeking pathway, where sensation seeking is specifically associated with increased alcohol use and alcohol seeking behaviors, which, in turn, is associated with alcohol problems and (ii) a social deviance pathway where social deviance proneness is directly associated with more alcohol problems (Finn, 2002; Finn and Hall, 2004; Finn et al., 2000; Mustanski et al., 2003). Sensation seeking and social deviance are typically correlated and both, ultimately, are associated with alcohol problems; however, the evidence suggests that each pathway is associated with a different vulnerability process (Finn et al., 2002; Mustanski et al., 2003). The sensation seeking pathway is associated with a predisposition toward excessive alcohol use that involves, in part, an increased sensitivity of appetitive motivational processes (Finn et al., 2002). High sensation seekers show a pattern of heightened heart rate reactivity to alcohol consumption thought to reflect increased appetitive processes and are more sensitive to the invigorating properties of alcohol, while being less sensitive to the sedative and unpleasant effects of alcohol intoxication (Finn et al., 1992; Ray et al., 2006). Research also suggests that sensation seeking is associated with increased sensitivity to novel stimuli, including approach

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stimuli (sexual) and intense sensory stimuli (Smith et al., 1990; Zuckerman, 1990). Increased sensation seeking was also associated with reduced sensitivity to stressors (Lissek et al., 2005; Roberti, 2004; Zuckerman, 2005). This pattern suggests that high levels of sensation seeking are associated with a stronger appetitive-approach system and a weaker avoidance-withdrawal system than do low levels of sensation seeking (Depue and Collins, 1999; Lang et al., 2005). Both a stronger appetitive-approach system and a weaker avoidance-withdrawal system predispose to excessive substance use (Finn et al., 2002). On the other hand, the social deviance pathway is associated with reduced behavioral control, reduced executive ability, and poor self-regulation (Finn and Hall, 2004; Finn et al., 2000, 2002) and appears to reflect a general predisposition toward problems with self-regulation and self-control. The evidence suggests that increased sensation seeking promotes higher levels of substance use and, once use levels are elevated, social deviance is associated with an inability to control use which leads to excessive alcohol-related problems (Finn et al., 2000, 2002).

The research on sensation seeking, social deviance, and alcohol use and abuse has focused primarily on populations who are actively using or who are entering a period of life, such as adolescence, when use and abuse typically escalates. Very little is known about the association between sensation seeking, social deviance, and long-term abstinence. Because sensation seeking is associated with high levels of alcohol use and alcohol seeking behavior, elevated levels of sensation seeking would represent a liability to relapse in abstinent alcoholics. Thus, reductions in sensation seeking in alcoholics attempting to be abstinent are likely to be associated with greater success in remaining abstinent. Our recent studies indicate that long-term abstinent alcoholics (LTAA) show elevated levels of social deviance and poor decision making compared with controls (Di Sclafani et al., 2008; Fein et al., 2004, 2007). This suggests that in spite of the fact that they show evidence of poor self-regulation, on average, our LTAA sample remained abstinent for long periods of time. This study investigates sensation seeking in this sample of middle-aged LTAA, younger adult treatment-naïve actively drinking alcoholics (TxN), and age and gender comparable nonalcoholic controls (NAC). Social deviance, family history of alcohol problems, and alcohol use variables were also examined. Based on the idea that the ability to remain abstinent in LTAA is associated with reductions in sensation seeking, we test the hypothesis that middle-aged LTAA will evidence less of an elevation in sensation seeking than TxN, each compared to age and gender comparable NAC.

METHODS

Participants

Table 1 lists demographic and alcohol use information by group. The sample consisted of 2 cohorts, a middle-aged LTAA cohort and their age and gender comparable NAC and a younger TxN cohort with their age and gender comparable NAC. Both cohorts were recruited using postings at AA meeting sites, mailings, newspaper

advertisements, a local Internet site, and subject referrals. The LTAA group was comprised of 24 women and 28 men, ranging from 35 to 58 years of age (mean = 46.6 years), who were abstinent from alcohol and drugs (except nicotine and caffeine) for 6 months to 21 years (mean = 6.3 years). The inclusion criteria for the LTAA group were 1) met DSM-IV (American Psychiatric Association 2000) criteria for lifetime alcohol dependence and 2) abstinent for at least 6 months. A standard drink was defined as 12 oz. beer, 5 oz. wine, or 1.5 oz. liquor. NAC for the LTAA study consisted of 23 women and 25 men, ranging from 34 to 60 years of age (mean = 45.6 years).

The TxN group consisted of treatment-naïve actively drinking alcohol-dependent individuals, 37 women and 49 men, ranging in age from 20 to 50 years (mean = 31.2 years). NAC for the TxN study consisted of 30 women and 40 men ranging in age from 19 to 50 years (mean = 32.3 years). TxN participants met DSM-IV (American Psychiatric Association 2000) criteria for current alcohol dependence.

The inclusion criterion for all NAC was a lifetime drinking average of less than 30 standard drinks per month, with no periods of drinking more than 60 drinks per month. The following were the exclusion criteria for all participants: (i) lifetime or current diagnosis of schizophrenia or schizophreniform disorder using the computerized Diagnostic Interview Schedule (c-DIS) (Bucholz et al., 1991; Erdman et al., 1992; Levitan et al., 1991; Robins et al., 1998), (ii) history of lifetime or current drug abuse or dependence (other than nicotine or caffeine), (iii) significant history of head trauma or cranial surgery, (iv) history of significant neurological disease, (v) history of diabetes, stroke, or hypertension that required an emergent medical intervention, (vi) laboratory evidence of hepatic disease, or (vii) clinical evidence of Wernicke-Korsakoff syndrome.

Procedures

All individuals participated in the following assessments: (i) psychiatric diagnoses and symptom counts were gathered using the c-DIS (Robins et al., 1998), (ii) participants were interviewed on their lifetime drug and alcohol use using the timeline follow-back methodology (Skinner and Allen, 1982; Skinner and Sheu, 1982; Sobell and Sobell, 1990; Sobell et al., 1988), (iii) medical histories were reviewed in an interview by a trained research associate, and (iv) blood was drawn to test liver functions. Approval for the study was obtained from a free-standing independent human subjects research review committee (Independent Review Consulting, Corte Madera, CA), and written informed consent was obtained from all research participants.

Personality Measures. Sensation seeking was assessed using the Sensation Seeking Scale (Zuckerman, 1979) that was modified to remove questions that directly assessed alcohol or drug use (i.e., questions 9, 10, 13, 30, and 36). These questions were removed to eliminate criterion contamination. Social deviance proneness was assessed using the Socialization Scale of the California Psychological Inventory (CPI-SS) (Gough, 1969) and the Psychopathic Deviate Scale of the MMPI-2 (MMPI PD) (Hathaway and McKinley, 1989).

Statistical Analyses. The sensation seeking scales were analyzed using the General Linear Model implementation of the Multivariate Analysis of Variance within the Statistical Package for the Social Sciences (SPSS) (SPSS Inc., 2006). The LTAA cohort was significantly older than the TxN cohort.

RESULTS

As mentioned previously, because LTAA were older than TxN, we recruited 2 different (age and gender comparable)

Table 1. Demographic, Alcohol Use, and Deviance Proneness Measures^a

	Uncombined Nonalcoholic Controls (NAC)										Effect size ^{b,c} (%) versus Combined NAC			
	Long-Term Abstinent Alcoholics (LTAA)		Treatment-Naïve Active Alcoholics (TxN)		For LTAA (middle-aged)		For TxN (young adult)		LTA	TxN				
	Men (n = 28)	Women (n = 24)	Men (n = 49)	Women (n = 37)	Men (n = 25)	Women (n = 23)	Men (n = 40)	Women (n = 30)	versus NAC	versus TxN				
Demographic variables														
Age	45.0 ± 6.9	48.4 ± 6.4	31.3 ± 7.8	31.0 ± 6.7	43.4 ± 6.3	48.0 ± 6.6	32.5 ± 8.5	32.0 ± 8.7	23.8***	2.4***	1.3			
Education (years)	15.6 ± 2.0 (n = 27)	15.8 ± 2.3 (n = 20)	16.1 ± 1.8	15.8 ± 1.6	16.3 ± 2.2	16.0 ± 1.9	16.4 ± 1.8	16.3 ± 1.4	1.3	0.6	0.3			
Family drinking density ^d	0.40 ± 0.3	0.44 ± 0.3	0.14 ± 0.2 (n = 48)	0.25 ± 0.3	0.14 ± 0.2	0.17 ± 0.2	0.12 ± 0.17	0.13 ± 0.25	23.8***	2.4***	1.3			
Alcohol use variables														
Lifetime dose (std. drinks/month)	179 ± 149 (n = 27)	137 ± 81 (n = 20)	100 ± 45	78 ± 88	6.9 ± 8.3	6.8 ± 7.6	7.09 ± 6.8	5.7 ± 4.9	51.7 ^e	11.4***	46.5 ^e			
Peak dose (std. drinks/month)	341 ± 257 (n = 27)	287 ± 213 (n = 20)	181 ± 121	152 ± 205	15.1 ± 14.45	16.7 ± 22.4	15 ± 15	14 ± 16	53.0 ^e	11.8***	33.5 ^e			
Age started drinking	14.8 ± 2.9	17.1 ± 5.6	16.0 ± 1.8	15.8 ± 2.1	18.8 ± 4.9	20.4 ± 4.9	19.31 ± 4.0	N/A	11.6***	0.0	18.3***			
Age first heavy use	21.5 ± 4.6	26.1 ± 8.1	22.1 ± 5.5	21.7 ± 5.6	N/A	N/A	N/A	N/A	N/A	2.4	N/A			
Abstinence (days)	2167 ± 2175	2571 ± 2142	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
Deviance proneness measures^f														
MMPI psychopathic deviance scale	21.8 ± 4.2	21.5 ± 3.8	19.0 ± 4.3	19.6 ± 5.3	16.7 ± 3.0	16.2 ± 3.2	16.3 ± 3.1	16.0 ± 3.7	33.5***	6.1**	12.6***			
CPI socialization scale	27.4 ± 5.7	29.8 ± 5.9	31.4 ± 4.4	31.0 ± 6.0	36.2 ± 4.0	36.3 ± 3.1	35.9 ± 4.4	37.1 ± 3.8	38.0***	5.3**	24.5***			

^aMeasures are reported as mean ± standard deviation.

^bPercent of variance of dependent variable accounted for by group membership (SPSS's partial eta squared).

^cEffect is significant: * $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$.

^dFamily drinking density is the proportion of first-degree relatives who were problem drinkers; statistical analysis was performed after arcsine transformation.

^eAlthough we present values, statistical comparisons are not valid because these measures are associated with the sampling plan.

^fScales run in opposite directions; i.e., higher "psychopathic" scores = greater deviance, but higher socialization scores = greater socialization.

control groups (see Table 1). Before comparing LTAA to TxN, we examined for cohort effects by comparing their respective control groups on the SSS. There was no multivariate difference between the control samples on the SSS (Wilkes $\lambda_{4,111} = 0.989$, $p = 0.417$) nor were there differences on any SSS subscale (all p 's > 0.17 , all effect sizes $< 1.6\%$ of the variance), indicating that the control groups could be combined in further analyses. The lack of cohort effects also supports the direct comparison of the LTAA and TxN samples. These results suggest that total SSS scores in NAC did not change with age, which was confirmed by correlation analysis (Spearman's rho comparing total SSS score with age: entire NAC sample = -0.11 , $p = 0.23$; NAC for TxN study = -0.13 , $p = 0.27$; NAC for LTAA study = 0.00 , $p = 0.98$).

LTAA Versus NAC and TxN in Sensation Seeking

Table 2 presents the SSS scores for male and female LTAA, TxN, and (combined) NAC together with effect sizes and significance levels for multivariate and univariate group effects.

We first compared LTAA to the combined NAC group (a 2×2 design with Group and Gender as fixed effects and the 4 SSS subscales as the dependent variables). The multivariate analysis showed a significant gender effect (Wilkes $\lambda_{4,93} = 6.16$, $p < 0.0001$; men having greater sensation seeking than women), but no significant group (Wilkes $\lambda_{4,93} = 1.025$, $p = 0.399$) or group by gender effect (Wilkes $\lambda_{4,93} = 0.799$, $p = 0.529$).

The next comparison, TxN versus the combined NAC group (also a 2×2 design with Group and Gender as fixed effects), did show multivariate effects of group (Wilkes $\lambda_{4,149} = 6.048$, $p < 0.0001$; TxN $>$ NAC) and gender (Wilkes $\lambda_{4,149} = 3.886$, $p = 0.005$; men $>$ women), but no significant group by gender interaction (Wilkes $\lambda_{4,149} = 0.727$, $p = 0.575$). TxN compared to NAC had higher scores on Disinhibition (group accounting for 12.6% of the variance, $p < 0.0001$), Thrill and Adventure Seeking (group

accounting for 8.1% of the variance, $p < 0.001$), and Experience Seeking (group accounting for 3.1% of the variance, $p < 0.05$), but not Boredom Susceptibility (group accounting for 1.2% of the variance, $p = 0.12$).

Our third comparison, LTAA versus TxN (also a 2×2 design with Group and Gender as fixed effects), showed significant multivariate effects for group (Wilkes $\lambda_{4,131} = 4.03$, $p = 0.004$; TxN $>$ LTAA) and gender (Wilkes $\lambda_{4,111} = 6.28$, $p = 0.0001$; men greater than women), but no significant group by gender interaction (Wilkes $\lambda_{4,131} = 1.62$, $p = 0.174$). TxN compared to LTAA had elevated scores on Disinhibition (group accounting for 8.6% of the variance, $p < 0.001$), Boredom Susceptibility (group accounting for 5.3% of the variance, $p = 0.007$), and Thrill and Adventure Seeking (group accounting for 4.5% of the variance, $p < 0.05$), but not Experience Seeking (group accounting for 1.3% of the variance, $p = 0.18$).

Figure 1 shows the data for LTAA, TxN, and the combined NAC group. To insure that the age difference between studies did not confound analysis of group by gender interactions, we reanalyzed each alcoholic group against its own age comparable NAC. These comparisons also showed no group by age effects (p 's ≥ 0.53 , effect sizes $\leq 3.3\%$ of the variance).

LTAA Versus TxN and NAC on Measures of Social Deviance

Table 1 presents the CPI Socialization Scale and the MMPI Psychopathic Deviance Scale scores for male and female LTAA, TxN, and NAC together with effect sizes and significance levels for group effects. Congruent with our approach to possible cohort effects between the LTAA and TxN studies, we compared the LTAA study NAC with the TxN study NAC on social deviance (a 2×2 design with Group and Gender as fixed effects and the 2 social deviance measures as dependent variables). There were no effects of group, gender, or group by gender (all Wilkes $\lambda_{2,113} < 1.07$, p 's > 0.347). Given this result, the 2 NAC samples were combined into a single control group for subsequent analyses and

Table 2. Sensation Seeking Scales Scores^{a,b}

	Long-Term Abstinent Alcoholics (LTAA)		Treatment-Naïve Active Alcoholics (TxN)		Combined Nonalcoholic Controls (NAC)		Effect size (%) ^{c,d}		
	Men (n = 28)	Women (n = 24)	Men (n = 49)	Women (n = 37)	Men (n = 53)	Women (n = 65)	LTAA versus NAC	LTAA versus TxN	TxN versus NAC
Multivariate tests							2.8	11.0**	15.0***
SSS subscales									
Disinhibition	4.4 ± 1.4	3.0 ± 1.8	4.8 ± 1.5	4.6 ± 1.7	4.0 ± 1.6	3.1 ± 1.2	0.2	8.6***	12.6***
Boredom susceptibility	4.3 ± 2.2	2.5 ± 1.4	4.9 ± 1.8	3.7 ± 2.0	4.4 ± 1.94	3.4 ± 1.8	1.5	5.3**	1.2
Thrill/adventure seeking	7.4 ± 2.5	5.5 ± 2.6	7.5 ± 2.3	7.5 ± 2.5	6.4 ± 2.5	5.5 ± 2.8	0.6	4.5*	8.1***
Experience seeking	5.0 ± 1.5	5.0 ± 1.1	5.4 ± 1.5	5.4 ± 1.4	4.7 ± 1.7	4.9 ± 1.3	0.4	1.3	3.1*

^aScales were modified to remove all items directly mentioning drug or alcohol use.

^bMeasures are reported as mean ± standard deviation.

^cEffect size is the percent of the dependent variable accounted for by the effect (SPSS's partial eta squared).

^dEffect is significant: * $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$.

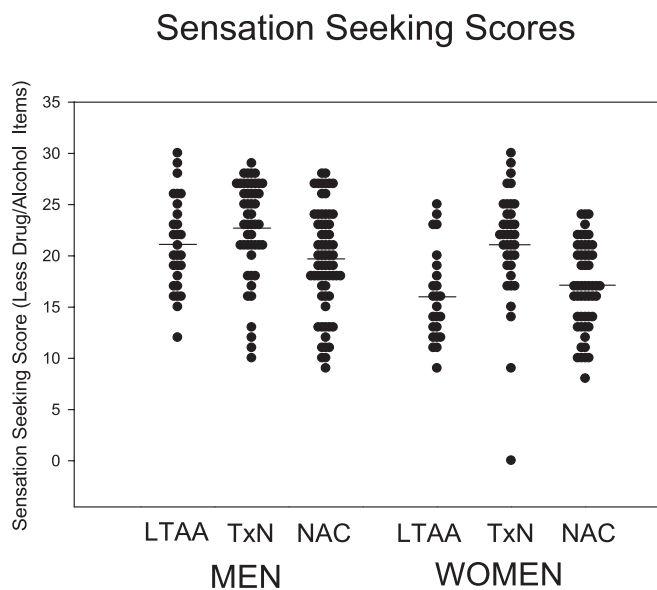


Fig. 1. This figure shows the modified SS score for all subjects in both the LTAA and TxN studies. The combined NAC group (from both the LTAA and TxN studies) is presented here. The horizontal lines show the mean SS score for each subgroup. This figure shows that SS scores are lower in women than men, higher in TxN compared to both NAC and LTAA, and do not differ between LTAA and NAC. Although these group findings appear to be of different magnitude in men and women, the differences are not significant (i.e., there are no significant group by gender interactions).

the LTAA and TxN samples were able to be directly compared, without concern for cohort effects. We have previously reported higher social deviance in both LTAA and TxN compared to their respective control groups (Di Sclafani et al., 2008). Comparing LTAA to TxN, we found greater social deviance in LTAA (Wilkes $\lambda_{2,113} = 5.213, p = 0.007$, with group accounting for 7.3% of the multivariate variance of the social deviance measures).

Sensation Seeking, Drinking History, and Social Deviance

There were no significant correlations within LTAA or TxN of any alcohol use variable with total SSS, CPI Socialization Score, or MMPI Pd Score. In both groups, SSS was negatively correlated with the CPI Socialization Scale ($r = -0.332, p = 0.002$ in TxN; $r = -0.364, p = 0.008$ in LTAA) but was not correlated with the MMPI Pd Scale (r 's $< 0.26, p$'s > 0.12). Within TxN and LTAA, CPI Socialization Score and MMPI Pd Score were negatively correlated after controlling for the SSS ($r = -0.400, p = 0.004$ for LTAA; $r = -0.606, p < 0.0001$ for TxN).

DISCUSSION

There were 2 major findings in this study: (i) sensation seeking in middle-aged LTAA was not different from sensation seeking in NAC and (ii) TxN had greater sensation seeking than both NAC and LTAA. With regard to the first finding, there are 2 possible interpretations. The most conservative

interpretation of this finding is that LTAA had normal sensation seeking *before* the initiation of abstinence. The alternative interpretation is that there was a significant normalization of sensation seeking (supportive of long-term abstinence). Our investigations and those of others have shown that alcoholics who undergo treatment, like the great majority of these LTAA, have a more severe disorder than those who do not seek treatment (Di Sclafani et al., 2008; Fein and Landman, 2005; Moss et al., 2007). Indeed, in the samples studied here, we have shown that LTAA compared to TxN have more severe alcohol use histories and a greater family history density of alcohol problems (Fein and Landman, 2005), more impaired decision making (Fein et al., 2004, 2006a,b), more psychiatric (especially externalizing) diagnoses and symptoms, and more abnormal psychological measures of the substrates for these psychiatric problems (Di Sclafani et al., 2008). In the current data, psychopathic deviance scores and socialization scores were more deviant in LTAA than in TxN but were comparably correlated with sensation seeking scores in both groups. In addition, over 3 quarters of LTAA were members of AA, a 12-step program that strongly and repetitively espouses more normative behavior with regard to sensation seeking, consistent with normalization of elevated sensation seeking as an important aspect of 12-step recovery. Based on these reasons, we expected LTAA to have elevated sensation seeking compared to both NAC and TxN and see the lack of this finding as suggesting a normalization of sensation seeking (from such elevated values) in LTAA. Moreover, as we required a minimum of 6 months abstinence for LTAA and sensation seeking scores were not correlated with duration of abstinence in LTAA, we hypothesize that the bulk of the reduction in sensation seeking in LTAA occurred in early sobriety.

Our second finding was that TxN showed greater sensation seeking than both NAC and LTAA. That TxN showed greater sensation seeking than NAC was expected, given that TxN were heavy drinkers, were more socially deviant and had more lifetime externalizing symptoms than NAC (Di Sclafani et al., 2008; Fein and Landman, 2005). As stated earlier, we believe that the greater sensation seeking in TxN compared to LTAA primarily reflects a normalization of sensation seeking in LTAA.

A potential caveat to our findings is the possibility that our modification of the SSS (removal of all items directly addressing drug or alcohol use) decreased the scale's sensitivity to detect differences between LTAA and NAC that do, in fact, exist. We reject this possibility for 2 reasons. First, our modified SSS was sensitive enough to detect increased sensation seeking in TxN compared to both NAC and LTAA. Second, the modified scales are more than sensitive enough to detect the higher sensation seeking scores in men versus women. In the literature cited in the introduction (Andrucci et al., 1989; Conrod et al., 2008; Croissant et al., 2008; Earleywine and Finn, 1991), gender differences on the SSS are of comparable or less magnitude than are differences between alcoholics and nonalcoholics.

Interestingly (particularly in a discussion of alcoholism), Boredom Susceptibility is the subscale least associated with genetic heritability in twin studies. Koopmans and colleagues (1995), in a twin sample of 1700 adolescent pairs, found that the least heritable subscale in women was Boredom Susceptibility, while an even larger extended twin study by Stoel and colleagues (2006) found that the least heritable subscale was Boredom Susceptibility, regardless of gender. Hur and Bouchard (1997) studied 57 pairs of identical and 49 pairs of fraternal twins, all of whom were reared apart, and also found the least heritability for Boredom Susceptibility. All individuals in this last study also completed the Control scale of the Multidimensional Personality Questionnaire. The Control scale was negatively correlated with sensation seeking (consistent with the strong association between impulsivity and sensation seeking in previous studies [reviewed by Zuckerman (1993)] and our current findings vis-à-vis social deviance and sensation seeking in the alcoholic groups). The proportion of the genetic variance of the Control scale in common with the SSS was estimated as 55%, pointing to common biologic mechanisms for associations between impulsivity and sensation seeking traits (Hur and Bouchard, 1997).

In conclusion, we expected to find increased sensation seeking in both alcoholic groups compared to NAC. Further, based on the greater magnitude of psychological, psychiatric, drinking history, and family history of drinking problems in LTAA, we expected to find elevated sensation seeking when LTAA were compared to TxN. However, in these samples, sensation seeking is normal in LTAA and elevated in the actively drinking TxN. Our finding of normal sensation seeking in LTAA is novel and suggests that normalization of sensation seeking in early abstinence may be a "sine qua non" of long-term abstinence. Alternatively, normal sensation seeking may be a predictor of the ability to achieve long-term abstinence. Longitudinal data are needed to resolve this issue. Regardless of the relative contribution of the 2 phenomena, the results have important implications for our understanding of long-term sobriety.

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