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Sub-Clinical Anxiety and the Onset of Alcohol Use Disorders: Longitudinal Associations from the Baltimore ECA Follow-Up, 1981–2004*

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Abstract

The current study examines the longitudinal relationship between anxiety disorders in general, specific phobia in particular, and subsequent-onset alcohol use disorders in an adult population-based sample. In addition, we explore whether the hypothesized associations vary by gender. Approximately 23 years of data from the Baltimore ECA (Epidemiological Catchment Area) Follow-up (N=587) allow for the estimation of the development of incident alcohol use disorders in later life among those with anxiety disorders at the time of the baseline interview in 1981. Though baseline specific phobias were common, neither number of, nor any specific fear was statistically associated with the onset of alcohol use disorders. Rather, the findings suggested a modest association between adult sub-clinical specific phobia (without substantial distress or interference) and later-onset alcohol use disorders (OR=3.2). Moreover, we find that this association might be stronger for women than for men.

Keywords

Anxiety; Alcohol; Sub Clinical; Specific Phobia; Cohort

INTRODUCTION

There is research supporting a linkage between anxiety disorders and alcohol use disorders.^{1–5} Cross-sectional studies of alcohol use disorders and anxiety disorders suggest an association between the two conditions.^{6,7} However, cross-sectional designs are limited in their ability to explore temporal relationships; prospective designs can provide stronger evidence of causal relationships between psychiatric phenomena.

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Abundant scientific evidence suggests that alcohol use allays anxiety. However, providing a scientific framework within which to test this belief has proven more difficult. Allan notes the lack of an adequate theoretical basis or model has hampered research in this area.⁸ Despite this proposition, there are at least two theories that provide a framework for scientific analysis. The first comes from the field of psychoanalysis and suggests that people with psychopathology are predisposed to self-medicate resulting in the development of various substance use disorders.⁸ Within this framework, one would expect that anxiety disorders would precede the onset of severe and clinical alcohol disorders. The second perspective is the tension reduction hypothesis.⁹ In this perspective, alcohol reduces tension and when confronted with stressful situations, people learn to use alcohol to allay the unpleasant effects.

There are few studies that use diagnostic criteria and are large enough to make generalizations to populations. Results from a longitudinal study of college freshmen suggest that anxiety disorders in late adolescence/young adulthood add risk for subsequent alcohol use disorders in young adulthood.¹⁰ A recent study of the temporal sequencing of anxiety disorders and alcohol use disorders suggests specific phobia tends to occur temporally prior to alcohol use disorders.¹¹ Evidence from animal studies also supports a genetic linkage between anxiety disorders and alcohol use disorders.¹² In humans, there have also been studies showing specific genes that are associated with comorbid alcohol use and anxiety.¹³ Furthermore, familial history of alcoholism appears associated with alcohol and anxiety disorders in offspring.¹

In addition, both alcohol and anxiety disorders vary by gender. Research has shown that females are more likely to develop internalizing disorders such as depression and anxiety whereas males are more likely to be diagnosed with disorders such as alcohol abuse and dependence.³ One study reported that women who were alcohol dependent had twice the prevalence of specific phobia as similar men - 20 percent versus 10 percent, respectively.¹⁴

Finally, there is evidence that alcohol problems may be different across age groups. More specifically, an aging cohort of individuals with alcohol use disorders presents different issues for researchers. Research on alcohol use among older populations consistently cite the problem of underdiagnosis of alcohol related problems, in part because older persons are more likely to develop alcohol related problems at a lower levels of alcohol consumption. Community-based studies estimate the prevalence of alcohol problems in older adults anywhere from 1% to 22%, depending on the sample, screening instrument, and/or age cutoff used to define the population.^{15,16} Much of the evidence suggests late-onset alcohol abuse or dependence is precipitated by a stressful life event such as divorce, retirement, or loss of a spouse.¹⁶ In addition women tend to develop more first-onset alcohol problems in later life and the increase in rates of alcohol problems across aging cohorts is greater for women than men.^{16,17}

The current study uses data from the 23-year Baltimore Epidemiologic Catchment Area (ECA) Follow-up to test the hypothesis that baseline anxiety problems in adults predict subsequent onset of alcohol use disorders. We hypothesized that females with baseline

anxiety problems would be at particularly increased risk for subsequent alcohol use disorders in this sample, in which all participants were adults at baseline.

METHODS

Study sample

Data for this study come from the Baltimore site of the Epidemiologic Catchment Area (ECA) study,^{18,19} and the most recent wave of the Baltimore ECA Follow-up.²⁰ ECA staff administered the Diagnostic Interview Schedule (DIS),²¹ a valid and reliable tool for assessing psychiatric disorders in populations. For a full description of the ECA and Baltimore ECA Follow-up see Eaton and colleagues.²⁰ The current analysis uses 2 time points of data. Wave 1 consisted of 3481 individuals and was collected in 1981. These same individuals were surveyed again one year later (wave 2). Between 1993 and 1996, 1920 participants from the baseline sample were interviewed again for wave 3.²² In 2004 and the first half of 2005, 1038 of persons interviewed in wave 3 were interviewed a fourth time. Attrition across the sample was cumulative because respondents were targeted for sampling in 2004 only if they were included in all previous waves. For the analyses in the current report, data from waves 1 and 4 were used. Of the 1038 respondents available for study at both wave 1 and wave 4, individuals who fit the criteria for either DSM alcohol abuse or dependence (n=225), or who were “heavy drinkers” (defined as having 5 or more drinks at least once over the last month prior to interview, n=226) were removed from the baseline sample, in order to focus our analyses on incident cases of alcohol abuse and/or dependence. By removing these two groups of respondents, we were more likely to have a “clean” sample of individuals with no reported history of alcohol abuse/dependence or heavy drinking. The final sample size for analyses was n=587.

Measures

Alcohol abuse and dependence were assessed at wave 4 using the DSM-IV criteria.²³ This measure identifies any respondent who met criteria for new onset of either alcohol abuse or dependence. *Anxiety disorders* were assessed in wave 1 using DSM-III criteria (the DSM version in use at the time of the baseline interview).²⁴ For the variable “any anxiety disorder,” disorders included: panic disorder, agoraphobia, social phobia, simple/specific phobia, and obsessive compulsive disorder. *Sub-clinical specific phobia* includes an unreasonable fear of a specific object or situation and the avoidance of such fear. In contrast to full-criteria specific phobia, sub-clinical specific phobia does not significantly interfere with a respondent’s life or activities. *Nervousness* is a single dichotomous variable that asked respondents “Are you a nervous person?”

Other covariates included in the analyses were: race (Black/Non-Black), age, sex, marital status, and level of education (dichotomized to those with less than 12 years of education, and those with 12 or more). Histories of psychiatric and substance use disorders were grouped as: schizophrenic disorders (schizophrenia or schizophreniform disorder), affective disorders (depression, mania, bipolar disorder, and dysthymia), and substance abuse and dependence (which included abuse and/or dependence of barbiturates, sedatives, hypnotics, opioids, cocaine, amphetamines, hallucinogens, and/or cannabis), and self-reported parental

history of heavy drinking were also included in adjusted models. Each of these additional covariates were assessed at the baseline interview in 1981 and the psychiatric conditions were assessed using DSM-III criteria.

Data Analysis

Data analyses were performed using STATA version 9. Initial exploratory analyses were performed showing the distribution of anxiety disorders and alcohol abuse and dependence by sociodemographic variables. Chi square and Fisher exact tests were used to determine statistical significance. In order to test our first hypothesis, we used logistic regression models to estimate the magnitude of the association linking anxiety disorders (both full criteria and sub-clinical) with incident alcohol abuse or dependence adjusting for demographic variables, and previous psychiatric history. Logistic regression models produced the odds ratios and 95% confidence intervals reported in the tables. In order to address our second hypothesis, we performed these analyses separately for women and men by stratifying the sample on sex. Again, logistic regression models were used to produce odds ratios and 95% confidence intervals.

RESULTS

Table 1 shows the distribution of the variables in the focal relationship, with the independent variable measured in two ways: the presence of any DSM-III anxiety disorder and the nervousness variable. Females, African Americans, individuals with less education, individuals that had another psychiatric disorder, and the unmarried had a significantly higher frequency of anxiety disorders. No statistically significant differences were found with regard to baseline age. Exploration of the distribution of the nervousness variable revealed only two statistically significant associations: Non-Blacks and those with affective disorders had a higher frequency of self-reported nervousness. With regard to incident alcohol abuse and dependence, the lone statistically significant predictor was baseline age; however, it is possible this is a product of the time lag between the focal relationship variables.

In addition to the variables in the focal relationship, we also explore the distribution of both clinical and sub-clinical level specific phobia. In preliminary analyses of each separate anxiety disorder (data not shown)--it was this variable in particular that was driving much of the focal relationship between anxiety disorders and subsequent alcohol abuse and dependence. Therefore, we explored the social distribution of both specific phobia and sub-clinical specific phobia. Sub-clinical specific phobia was more common than full-criteria specific phobia. Though there was only a single statistically significant association among diagnosable specific phobias (higher frequency among those with prior affective disorder), we found many associations at the sub-clinical level. African Americans, females, and those with fewer reported years of education all had higher prevalences of sub-clinical specific phobia.

Exploring the relationship between specific and sub-clinical specific phobias, we looked at the distribution of the specific fears in Table 2. The most common phobias were: bugs, spiders, mice, and snakes followed by heights. In addition, table 2 reports the number of

fears reported at the clinical and sub-clinical level. Most common were no fears at all and the individuals who reported greater numbers of fears decreased inversely with the number of fears.

Table 3 presents the results of an initial logistic regression of alcohol abuse or dependence on a variety of anxiety variables. Unadjusted results suggest elevated but non-significant odds ratios for alcohol abuse or dependence given the presence of any anxiety disorder or being a nervous person. Controlling for demographics in model 2 and for other potential confounders in model 3, we did not find any relationships that met criteria for statistical significance. Exploring each anxiety disorder separately also did not yield any statistically significant relationships. However, further analysis of sub-clinical levels of any anxiety disorder in general and specific phobia in particular suggests some strong associations. Table 3 does show a lone statistically significant relationship between any sub-clinical anxiety disorder and the subsequent onset of alcohol abuse or dependence. However, this relationship did not hold at either the zero order or with all potential confounders.¹ The only persistent and statistically significant relationship in all three models was that of sub-clinical specific phobia with onset of alcohol abuse or dependence. Odds ratios ranged from 2.57 unadjusted to 3.16 in the fully adjusted model.

Results from Table 4 suggest that females with sub-clinical anxiety disorders (including specific phobia), compared to females without, might have significantly elevated odds for the subsequent onset of alcohol abuse or dependence. Females with sub-clinical anxiety disorder and sub-clinical specific phobia are approximately three to six times as likely to develop an alcohol use disorder as those without a sub-clinical anxiety disorder (OR 3.55 to 5.76). No statistically significant relationships were found for males.

DISCUSSION

The scarcity of community-based longitudinal studies of the relationship between anxiety disorders and alcohol use disorders was primary in guiding this study. Using data from a 23-year longitudinal cohort study, we explored the relationship between anxiety disorders and subsequent alcohol abuse or dependence. We were able to provide evidence of an association between sub-clinical anxiety disorders and the onset of alcohol abuse or dependence; however, we found less evidence to support such a relationship using anxiety disorder diagnoses. These findings are inconsistent with both self-medication and the tension reduction hypothesis. One would expect to find a dose-response increase in alcohol use among more full-criteria cases of anxiety; however, our results suggest subsequent alcohol disorders among those with less severe anxiety. One probable explanation is the limited sample size to assess these associations for specific diagnoses. However, it is also possible that those with more severe anxious conditions may not necessarily use alcohol to problematic excess to allay the symptoms of anxiety. This may be the case for example, if individuals with sub-clinical phobic fears are more likely to participate in activities that put them in contact with alcohol. Our most robust findings came from relationships between

¹The full model for sub-clinical anxiety disorder and alcohol abuse/dependence reported $p < .05$ is a result of rounding (actual p value = .051). The confidence interval for this model contains 1 and is therefore not significant at $p < .05$.

sub-clinical anxiety disorders and the onset of alcohol abuse or dependence. Despite the lack of statistical significance in many of the associations, we suggest there is an underlying association between anxious symptomatology and the onset of alcohol use disorders. We were able to show elevated odds ratios for the majority of the associations, and we suspect we would have approached statistical significance with a larger sample size. In addition, we were able to provide evidence that the anxiety/alcohol relationship may operate differently for men and women. In our sex-stratified analyses, sub-clinical specific phobia appeared to be a stronger predictor of later alcohol use disorders among females. Perhaps alcohol consumption differs as men and women age. Because of differing social roles (e.g. mothering), women may be less likely to self-medicate anxiety disorders with alcohol until later in life. The gender difference may also be an artifact of timing. It is perhaps the case that by removing alcohol abusers, dependents, and heavy drinkers from the baseline sample, we have removed a preponderance of men with both anxiety and alcohol disorders. In other words, it may be the case that men develop alcohol problems earlier in life, and the onset is much quicker than for women. Future research should explore these possibilities.

We believe the unique contributions from this study are threefold. First, we were able to contribute to a growing literature on the association between anxiety disorders and alcohol use disorders. Even though prior studies have shown an association between the two, relatively few have used a longitudinal study design with temporal ordering. By employing such a design, we were able to explore potential causal relationships. Second, we explored an understudied group of anxiety disorders, specific phobias, and were able to provide limited evidence of an association with the onset of alcohol abuse and dependence. Despite specific phobias having a lifetime prevalence of nearly 10 percent,²⁵ having substantial interference with daily activities,²⁶ and comorbidity with other disorders,²⁷ little attention has been devoted to their study. Finally, we were able to explore anxiety disorders and specific phobia, including sub-clinical syndromes. Again, we found that sub-clinical specific phobias and fears are associated with increased odds of problem drinking.

There are several limitations in our study that should be mentioned. First, given the nature of the data collection time frame, the assessment of the disorders in the focal relationship use two different versions of the DSM. Anxiety disorders were measured using DSM-III criteria, but alcohol abuse and dependence were measured using DSM-IV criteria. Though there are certainly differences between versions of the DSM, we believe they do not severely bias the current findings. Second, by removing individuals at baseline with a history of heavy drinking and alcohol abuse or dependence, we lost a large proportion of our potential sample size. As a result, during analyses we encountered issues of limited power and wide confidence intervals. In addition, it is probable we have removed from our sample the individuals at the highest risk for developing alcohol disorders. Given the early onset of alcohol problems, our sample was substantially older than the target population. This almost certainly contributed to weak associations between anxiety disorders and the onset of alcohol problems. Third, prior research has suggested there is confounding between anxiety disorders and sedative use. We were able to hold constant in our analyses prior history of substance abuse and/or dependence which included barbiturate and sedative use disorders. However, we were not able to adjust for the non-pathological use of these prescription substances, which may have resulted in residual confounding. Finally, the sample relies

heavily on self-reported data and we recognize that respondents may underreport both socially stigmatizing fears and alcohol use. Given the time period of study, it is also not unreasonable to assume that respondents may have forgotten experiences related to both alcohol use and anxiety. The findings will need to be confirmed in future analyses.

SUMMARY

Our study lends modest support for the longitudinal relationship between anxiety and alcohol use disorders. The strength of our study is its community-based and prospective design. Despite the caveats mentioned above, this research contributes to the broader literature on the comorbidity between anxiety and alcohol as well as focusing not specifically on diagnostic classifications but also sub-clinical conditions, which improves our understanding of comorbid relationships between anxiety and risk for alcohol use disorders. Given the large prevalence in particular of subclinical anxiety symptoms, which may largely go unrecognized, these associations may have a significant impact on the occurrence of alcohol disorders in the general population.

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Table 1

Sociodemographic Distribution of any DSM-III Anxiety Disorder¹, Nervousness², Specific Phobia³, Sub-Clinical Specific Phobia⁴, and new onset of DSM-IV Alcohol Abuse or Dependence (N=587).

	Any Anxiety Disorder			Nervousness			Specific Phobia			Sub-Clinical Specific Phobia			Alcohol Abuse or Dependence				
	No	Yes	Percent	No	Yes	Percent	No	Yes	Percent	No	Yes	Percent	No	Yes	Percent	Chi ² p-val.	Chi ² p-val.
<i>Age</i>																	
18-29	167	54	24.4	183	38	17.2	215	6	2.7	185	36	16.3	206	15	6.8		
30-44	161	69	30.0	175	55	24.0	225	5	2.2	175	55	23.9	224	6	2.6		
45-64	92	29	24.0	96	25	21.0	119	2	1.7	95	26	21.5	121	0	0.0		
65+	10	5	33.3	14	1	6.7	15	0	0.0	10	5	33.3	15	0	0.0	0.01	
<i>Sex</i>																	
Male	116	21	15.3	114	23	16.8	136	1	0.7	123	14	10.2	128	9	6.6		
Female	314	136	30.2	354	96	21.3	438	12	2.7	342	108	24.0	438	12	2.7	0.03	
<i>Race</i>																	
Black	152	75	33.0	191	36	15.9	222	5	2.2	162	65	28.6	218	9	4.0		
White/Other	278	82	22.8	277	83	23.1	352	8	2.2	303	57	15.8	348	12	3.3	0.69	
<i>Marital Status</i>																	
Married	218	61	21.8	217	62	22.2	274	5	1.8	230	49	17.6	270	9	3.2		
Not Married	211	96	31.3	250	57	18.6	299	8	2.6	234	73	23.8	295	12	3.9	0.66	
<i>Education</i>																	
High School or More	315	101	24.3	333	83	20.0	407	9	2.2	341	75	18.0	403	13	3.1		
Less than High School	115	56	32.7	135	36	21.1	167	4	2.3	124	47	27.5	163	8	4.7	0.36	
<i>Any Psychiatric or Drug Use Disorder</i>																	
Yes	37	34	47.9	40	31	43.7	64	7	9.9	55	16	22.5	67	4	5.6		
No	393	123	23.8	428	88	17.1	510	6	1.2	410	106	20.5	499	17	3.3	0.32	

¹ Any anxiety disorder includes DSM-III panic disorder, obsessive compulsive disorder, social phobia, agoraphobia, and specific phobia

² Nervousness is a dichotomous variable "Are you a nervous person?"

³ Full DSM-III criteria

⁴ Sub-Clinical criteria with no severe interference

Table 2

Types of Fears associated with DSM-III Specific Phobia (full criterion A and fear with no interference) and number of fears among respondents (n and percent¹) n=587).

	Yes		No Interference	
	N	percent	N	percent
<i>Type of Fear</i>				
Spiders, bugs, mice, snakes	62	10.6	108	18.4
Heights	43	7.3	74	12.6
Being in the water	31	5.3	41	7.0
Tunnels or bridges	30	5.1	42	7.2
Storms	29	4.9	31	5.3
Other unreasonable fear	29	4.9	19	3.2
Transportation	25	4.3	28	4.8
Being in a closed place	19	3.2	36	6.1
Being in a crowd	14	2.4	31	5.3
Caged animals	14	2.4	15	2.6
Going out of house alone	9	1.5	10	1.7
Speaking with a group of friends	9	1.5	27	4.6
Speaking with strangers	9	1.5	13	2.2
Being alone	8	1.4	13	2.2
Eating in public	8	1.4	13	2.2
<i>Number of Fears</i>				
1	63	10.7	103	17.5
2	39	6.6	75	12.8
3	22	3.7	34	5.8
4 or more	23	3.9	33	5.6

¹Percent in the total population

Table 3

Odds ratios of the association of the presence of any wave 1 anxiety disorder¹ (full criteria and sub-clinical), specific phobia, (full criteria and sub-clinical), and nervousness² with new onset of DSM-IV alcohol abuse or dependence based on initial and multiple logistic regression analyses (n=587).

	New Onset Alcohol Disorder								
	Unadjusted Model 1			Model 2 ³			Model 3 ⁴		
	OR	95% CI ⁵	p-value	OR	95% CI	p-value	OR	95% CI	p-value
<i>Any DSM-III Anxiety Disorder</i>									
Full Criteria	0.93	0.12 – 7.52	0.95	1.04	0.12 – 8.83	0.97	0.70	0.07 – 6.76	0.76
Sub-Clinical	2.29	0.94 – 5.63	0.07	2.58	1.01 – 6.63	0.05	2.52	0.98 – 6.47	0.05
<i>DSM-III Specific Phobia</i>									
Full Criteria	3.06	0.37 – 25.43	0.30	4.27	0.48 – 38.16	0.19	2.93	0.28 – 30.94	0.37
Sub-Clinical	2.57	1.03 – 6.44	0.04	3.14	1.18 – 8.38	0.02	3.16	1.18 – 8.44	0.02
Nervousness	1.60	0.61 – 4.23	0.34	2.05	0.73 – 5.73	0.17	1.84	0.64 – 5.28	0.26

¹ Any anxiety disorder includes DSM-III panic disorder, obsessive compulsive disorder, social phobia, agoraphobia, and specific phobia.

² Nervousness is a dichotomous variable “Are you a nervous person?”

³ This model controls for age, gender, race, educational level, and marital status.

⁴ This model adds controls for lifetime history of affective disorders, schizophrenic disorders, illicit drug abuse and dependence, a history of household drinking, and the other DSM-III anxiety disorders including: panic disorder, obsessive compulsive disorder, social phobia, agoraphobia, and specific phobia.

⁵ CI, confidence interval.

Table 4

Odds ratios of the presence of wave 1 sub-clinical anxiety disorder¹, sub-clinical specific phobia, and nervousness² with new onset of alcohol abuse or dependence by gender based on initial and multiple logistic regression analyses (n=587).

	New Onset Alcohol Disorder					
	Unadjusted Model 1		Model 2 ³		Model 3 ⁴	
	OR	95% CI ⁵	p-value	OR	95% CI	p-value
<i>Females</i>						
Any Sub-Clinical Anxiety Disorder	3.55	1.09 – 11.60	0.04	4.67	1.33 – 16.38	0.02
Sub-Clinical Specific Phobia	3.82	1.14 – 12.79	0.03	5.53	1.52 – 20.18	0.01
Nervousness	2.72	0.85 – 8.78	0.09	3.20	0.94 – 10.96	0.06
<i>Males</i>						
Any Sub-Clinical Anxiety Disorder	1.83	0.35 – 9.56	0.47	1.43	0.25 – 8.43	0.69
Sub-Clinical Specific Phobia	2.74	0.51 – 14.69	0.24	2.15	0.34 – 13.62	0.42
Nervousness	0.60	0.07 – 5.06	0.64	0.95	0.10 – 9.06	0.96

¹ Full criteria anxiety disorders were removed due to insufficient cell sizes.

² Nervousness is a dichotomous variable “Are you a nervous person?”

³ This model controls for age, race, educational level, and marital status.

⁴ This model adds controls for lifetime history of affective disorders, schizophrenic disorders, illicit drug abuse and dependence, a history of household drinking, and the other DSM-III anxiety disorders including: panic disorder, obsessive compulsive disorder, social phobia, agoraphobia, and specific phobia.

⁵ CI, confidence interval.