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## Personality antecedents of alcoholism in a national area probability sample

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**Abstract** Kraepelin viewed alcoholism as a symptom complex caused by heritable individual differences in emotional predisposition and volitional control. Recent clinical and genetic research has distinguished subtypes of alcoholics with different personality traits, symptoms, course, mode of inheritance, and response to treatment. The heritable personality traits that influence the initiation, continuation, and severity of alcoholism were examined by interview of a national area probability sample of 1019 non-institutionalized adults across the continental United States of America. We found that harm avoidance inhibits the initiation and frequency of drinking, but increases the risk of developing problems once frequent drinking has begun. Novelty seeking increases the initiation of drinking and the probabilities of frequent and problem drinking. This supports Kraepelin's description of the etiology and course of alcoholism as a symptom complex related to individual differences in emotional predisposition.

**Key words** Alcoholism · Harm avoidance · Personality traits · Novelty seeking

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### Introduction

Kraepelin shaped modern psychiatry by his classification of psychiatric disorders into multiple discrete categories. As with the psychoses, he described alcoholism according to differences among patients in their etiology, symptoms, course, and treatment. Kraepelin (1904) emphasized the importance of heritable influences that diminish the power to resist drinking, citing a strong familial tendency regardless of social class. He also noted the importance of environmental influences, such as head injury, and social factors such as the increased occupational risk in bartenders, liquor dealers, and brewers. He also noted the greater risk of alcoholism in men compared with women. Kraepelin (1904) complained about casual public attitudes toward intemperance and about public ignorance of the harmful medical and social consequences of alcoholism. He personally forbade his staff to smoke or drink (Carlson 1981). He suggested that parental drinking during pregnancy increased the risk to children for physical defects and their own alcoholism.

In terms of symptomatology, Kraepelin (1904) described the gradual and progressive impairment of intellectual faculties in alcoholics, beginning with reduced work capacity, reduced flexibility in changing habits, followed by impairment of judgement and moral standards. He noted that the excuses offered by alcoholics for their abuse ranged from heat exposure to cold exposure and other idiosyncratic external circumstances. Thus, his clinical description of alcoholics approximately a century ago is similar to that reported presently (Helzer et al. 1991).

Although Kraepelin is most noted for his classification of disorders into discrete categories, his basic concept was that psychiatric disorders are "not diseases, but symptom complexes" (Kraepelin 1883). The symptom complexes were viewed as functional interactions among diffuse brain processes. He particularly agreed with his mentor Wilhelm Wundt (1903) that all individuals differ quantitatively along multiple dimensions of personality including emotion and volitional control. According to Wundt (1903), the three dimensions of emotional predisposition were plea-

sure vs displeasure, excitement vs calmness, and tension vs relaxation. Kraepelin (1904) described several types of personality disorders as more-or-less discrete categories such as "born criminals" and "the unstable." However, he distinguished these personality disorders in terms of underlying differences in emotional predisposition and volitional control, which were quantitative.

Kraepelin's combined use of both categorical and dimensional approaches to clinical description is similar to some modern efforts to explain alcoholism and personality disorders in terms of the configuration of underlying personality traits (Cloninger 1987a, b; Cloninger et al. 1993; Svrakic et al. 1993). In this memorial issue dedicated to Emil Kraepelin, we first review recent research on the genetic architecture of alcoholism and personality. Then we report new epidemiological findings about the personality traits that influence the initiation, continuation, and cessation of alcoholism.

### Genetic architecture of alcoholism and temperament

The inheritance of alcoholism was studied in 862 Swedish men adopted by nonrelatives at an early age in the Stockholm Adoption Study (Cloninger et al. 1981). Information about the biological parents and the postnatal environments of the adoptees were associated with differences in their own risk of alcohol abuse. We distinguished two forms of alcoholism that have distinct genetic and environmental causes. Type-1 alcoholism was associated with late adult onset of alcoholism and rapid progression from mild to severe dependence with little or no criminality regardless of gender. Type-2 alcoholism was associated with teenage onset of recurrent social and legal problems from alcohol abuse particularly in men. These two types were initially distinguished in terms of their pattern of inheritance: the risk of type-1 alcoholism was increased mainly by the combination of a characteristic genetic and a characteristic environmental background, so that the average effect of genetic factors was weak. In contrast, the risk of type-2 alcoholism was highly heritable in men, but was seldom expressed in women. In subsequent work the two types were confirmed to differ in personality traits, age of onset, course, mode of inheritance, and response to treatment (Cloninger 1987a; Gilligan et al. 1987, 1988; Cloninger 1990; Babor et al. 1992; Litt et al. 1992).

Nevertheless, these two forms of alcoholism were not regarded as separate diseases (Cloninger et al. 1988b). In particular, both types often occurred in the same family. This is illustrated in Table 1 with data from the Stockholm Adoption Study. The risk of type-2 alcoholism is increased in sons with a genetic background characteristic of type 2 (17.2 vs 2.5%;  $P < 0.001$ ). In addition, there is no increased risk of type-1 abuse in those with a characteristics type-2 background. However, neither is there a decreased risk of type-1 abuse. Given the high prevalence of type-1 alcoholism in the general population, there is a substantial overlap of both types of alcoholism in some families.

**Table 1** Prediction of alcoholic subtypes in the Stockholm Adoption Study of 862 adopted men reared apart from their biological parents (Cloninger et al. 1981 and unpublished data)

Is genetic background type 2?	Is environmental background type 2?	Stockholm Men		
		N	% Type 1	% Type 2
No	No	567	14.4	1.9
No	Yes	196	10.7	4.1
Yes	No	71	9.9	16.9 <sup>a</sup>
Yes	Yes	28	17.9	17.9 <sup>a</sup>

<sup>a</sup>Sons with type-2 genetic background are more likely to be type-2 abusers than others (17.2% vs 2.5%;  $P < 0.001$ )

Further work suggested that different heritable personality traits explained the other clinical differences (Cloninger 1987a) and associations of alcoholism with personality disorders (Cloninger 1987b). The risk of type-2 alcoholism was increased by an antisocial personality type characterized by high novelty seeking (e.g., impulsive and disorderly), low harm avoidance (e.g., risk-taking and fearless), and low reward dependence (e.g., socially detached and cold-hearted). Such antisocial individuals begin experimenting with alcohol and other drugs at an early age, using it for its euphoriant effects. In contrast, the risk of type-1 alcoholism was increased by an anxious personality type characterized particularly by high harm avoidance (e.g., apprehensive and pessimistic). Such individuals are initially inhibited in their use of alcohol, but may rapidly become dependent on it when used for its anti-anxiety effects.

This hypothesis was initially tested by a prospective longitudinal study of 431 Swedish children (Cloninger et al. 1988a). The children had a detailed behavioral assessment at 11 years of age, including a detailed interview with their school teachers, and at age 27 years were reevaluated to identify alcoholism or alcohol abuse. Three dimensions of childhood personality variation were identified and rated without knowledge of adult outcome. These three dimensions (novelty seeking, harm avoidance, and reward dependence) were largely uncorrelated with one another, and each was found to be predictive of later alcohol abuse. Absolute deviations from the mean of each of the three personality dimensions were associated with an exponential increase in the risk of later alcohol abuse. High novelty seeking and low harm avoidance were most strongly predictive of early-onset alcohol abuse. These two childhood variables alone distinguished boys who had nearly 20-fold differences in their risk of alcohol abuse. The risk of alcohol abuse varied from 4 to 75% depending on childhood personality.

In subsequent research these same personality traits have been found to predict childhood conduct disorder (Tremblay et al. 1994), adolescent substance abuse (Wills et al. 1994), and adolescent social adjustment (Sigvardsson et al. 1987). Novelty seeking, harm avoidance, and reward dependence have also been shown to be approximately 50% heritable and to be etiologically independent of one another (Cloninger et al. 1993; Heath et al.

1994; Stallings et al. in press; Cloninger and Stallings in press).

There is wide diversity in the combination of personality traits observed in the general population, because of the causal independence of the three personality dimensions. Similarly, there is marked diversity among the personality configurations observed in alcoholics in treatment settings. Such diversity can be a cause of clinical differences among alcoholics, or it may be a consequence of treatment-seeking behavior and other selection pressures. Consequently, it is important to examine the relationships between personality and alcoholism in a sample of individuals representative of the general population. It is particularly important to examine the relations between personality and the initiation of drinking, the continued frequency of drinking, and the severity of alcoholic problems. Different aspects of personality may influence these aspects of drinking in distinct ways.

### Subjects and methods

The subjects were a national area probability sample of non-institutionalized adults in the continental United States. They were studied as part of the General Social Survey conducted by the National Opinion Research Council in 1987. The procedures for sampling and personality assessment have been described in detail elsewhere (Cloninger et al. 1991). The Tridimensional Personality Questionnaire (TPQ), version 4, was used to assess personality. The TPQ was scored to measure novelty seeking, harm avoidance, reward dependence, and persistence. Persistence was originally considered a subscale of reward dependence, but has subsequently been shown to be an independently inherited dimension (Cloninger et al. 1993).

Subjects were individually interviewed about their drinking frequency, quantity, and associated problems using a structured interview described elsewhere (Gilligan et al. 1988). Specific questions were asked about age of onset of alcohol-related problems and eight diagnostic symptoms including "benders," guilt, loss of control leading to broken rules, alcoholic liver disease, inability to abstain, fighting while drinking, arrests while drunk, and treatment for alcohol abuse.

Statistical analysis was carried out using the Statistical Analysis System, version 6.07 (SAS Institute 1989, 1992).

### Results

The drinking status of the 1019 subjects is summarized in Table 2. Among the 997 individuals who answered questions about both drinking and personality, 16% reported that they had never drunk ethanol at any time in their life.

The personality traits and age of the drinkers and non-drinkers were compared (Table 3). Both men and women who had never drunk were significantly lower in novelty seeking and older than others. Women who never drunk were higher in reward dependence and lower in persistence, but this was not significant when age was controlled.

The drinkers were divided into four groups according to their age at interview, as summarized in Table 4 for men and women separately. The cumulative percent of individuals with increasing numbers of alcoholic symptoms by age group is shown in Table 5 for men and Table 6 for women. Among the men, 10% reported four or more pro-

**Table 2** Drinker status in U.S. national probability sample

Drinker status	Men	Women	Total
Drinkers	408	429	837
Teetotalers	44	116	160
Missing data	10	12	22
Total	462	557	1019

**Table 3** Temperament profiles according to ever drinking

Temperament dimension	Ever drink	Never drink	<i>t</i>	<i>P</i>
Harm avoidance				
Men	10.8 ± 5.8	11.3 ± 5.1	-0.54	0.66
Women	12.8 ± 5.9	13.7 ± 5.5	-1.44	0.15
Novelty seeking				
Men	13.7 ± 5.0	11.2 ± 4.6	3.14	0.002
Women	13.4 ± 4.8	10.4 ± 4.1	6.78	0.0001
Reward dependence				
Men	12.7 ± 3.5	13.4 ± 3.2	-1.19	0.23
Women	14.0 ± 3.3	13.3 ± 3.2	2.17	0.03 <sup>a</sup>
Persistence				
Men	5.5 ± 2.0	5.2 ± 1.7	0.84	0.40
Women	5.6 ± 1.9	5.2 ± 1.8	2.24	0.03 <sup>a</sup>
Age (years)				
Men	42.7 ± 16.6	52.0 ± 18.0	-3.50	0.001
Women	41.6 ± 16.5	54.6 ± 18.9	-7.30	0.0001

<sup>a</sup>NS (*P* > 0.05) when age is controlled

**Table 4** Age distribution of drinkers in national probability sample

Age (years)	Men	Women	Total
18-29	94	113	207
30-39	113	132	245
40-49	77	61	138
50-99	124	123	247
Total	408	429	837

**Table 5** Distribution of number of eight symptoms of alcohol abuse by age in men

Number of symptoms	Cumulative % in each age group (years)				
	18-29 ( <i>n</i> = 94)	30-39 ( <i>n</i> = 113)	40-49 ( <i>n</i> = 77)	50+ ( <i>n</i> = 124)	Total ( <i>n</i> = 408)
5+	3	6	4	1	3
4+	12	13	9	8	10
3+	21	24	17	25	22
2+	46	41	37	40	41

NOTE: Symptoms = guilt, fights, drunk driving, rules, binges, inability to abstain, liver complications, and treatment

blems, and 22% reported three or more problems. Among the women, 3% reported four or more problems, and 8% reported three or more alcohol-related problems. Two symptoms, guilt and failure to keep own rules about drinking,

**Table 6** Distribution of number of eight symptoms of alcohol abuse by Age in women

Number of symptoms	Cumulative % in each group (years)				
	18-29 (n = 113)	30-39 (n = 132)	40-49 (n = 61)	50+ (n = 123)	Total (n = 429)
5+	1	2	3	0	1
4+	6	4	5	2	3
3+	10	12	10	4	8
2+	30	26	26	14	23

NOTE: Symptoms same as Table 5

**Table 7** Correlation of alcohol abuse with temperament

Temperament dimension	Correlation ( $\times 100$ ) by age (years)			
	18-29	30-39	40-49	50+
Novelty seeking				
Men	28**	18	6	3
Women	14	-2	-8	-9
Harm avoidance				
Men	-19	6	13	36***
Women	9	10	9	18*
Reward dependence				
Men	1	3	0	-11
Women	13	-2	-17	-25**

NOTE: Alcohol abuse = three or more alcoholic symptoms

\*  $P < 0.05$ \*\*  $P < 0.01$ \*\*\*  $P < 0.001$ 

were frequently reported and only weakly discriminated those with one or more of the other problems. Accordingly, individuals with three or more of the eight possible problems were diagnosed as alcohol abusers. This criterion provides estimates of the lifetime prevalence of alcoholism that agree closely with those based on other diagnostic procedures (Helzer et al. 1991; Selzer et al. 1975). For example, in the Epidemiologic Catchment Area Study, the lifetime prevalence of alcoholism was estimated as approximately 24% in men and 5% in women (Helzer et al. 1991). The severity of alcoholism was measured as the number of six highly discriminating symptoms of alcoholism, excluding guilt and broken rules about drinking.

The correlation between personality and alcohol abuse was considered in subgroups defined by their age and gender (Table 7). Novelty seeking was significantly correlated with alcohol abuse only in men under age 30 years. In contrast, harm avoidance was correlated with alcohol abuse in men and women aged 50 years or older. These older women were also lower in reward dependence. Persistence was not significantly correlated with alcohol abuse in any subgroup.

Essentially the same pattern of relations between temperament and any alcohol abuse was observed with severity of alcoholism, as shown in Table 8. Novelty seeking was positively correlated with severity of abuse in men younger than 30 years, whereas high harm avoidance and

**Table 8** Correlation of alcoholic symptom number with temperament

Temperament dimension	Correlation ( $\times 100$ ) by age (years)			
	18-29	30-39	40-49	50+
Novelty seeking				
Men	27**	15	12	7
Women	8	-5	-8	1
Harm avoidance				
Men	-6	4	15	32***
Women	4	5	5	18*
Reward dependence				
Men	-10	-6	0	-9
Women	12	0	-15	-21*

NOTE: Symptom number = number of six least frequent symptoms (excludes guilt and rules)

\*  $P < 0.05$ \*\*  $P < 0.01$ \*\*\*  $P < 0.001$ **Table 9** Correlation of current drinking frequency with temperament

Temperament dimension	Correlation ( $\times 100$ ) by age (years)			
	18-29	30-39	40-49	50+
Novelty seeking				
Men	34**	17	11	9
Women	19	15	37**	6
Harm avoidance				
Men	-17	2	-14	-6
Women	-13	-4	15	-20*
Reward dependence				
Men	-20	-15	-1	-1
Women	-15	-14	9	-16

NOTE: Frequency = drinking days per week

\*  $P < 0.05$ \*\*  $P < 0.01$ 

low reward dependence were correlated with severity in those aged 50 years or older.

The current drinking frequency of the subjects did vary widely, however (Table 9). Drinking frequency was higher in subjects who were high in novelty seeking, low in harm avoidance, and low in reward dependence. The differences were significant for novelty seeking in men under age 30 years and women aged 40 to 49 years. They were significant for low harm avoidance in women aged 50 years or older.

## Discussion

These observations indicate that ever drinking and frequency of drinking are related to *low* harm avoidance, whereas severity of alcoholism is related to *high* harm avoidance. In contrast, ever drinking, drinking frequency, and severity of alcoholism are all related to high novelty

seeking and low reward dependence. In other words, harm avoidance inhibits the initiation and frequency of drinking, but increases the risk of developing problems once frequent drinking has begun. Novelty seeking increases the initiation of drinking and the probabilities of frequent and problem drinking.

There were few individuals who were 50 years of age and reporting that the age of onset of their problems was before age 25 years. Accordingly, we cannot determine whether the relations between personality and alcohol abuse are related to age of onset or current age of the subjects. To our knowledge, the retrospective reporting of age of onset of alcoholism has not been validated in prospective studies. In treatment samples age of onset and current age are often confounded. For example, older alcoholics usually report either late onset or gradual progression of problems, whereas younger alcoholics in treatment report both early onset and rapid progression of problems.

The different patterns of onset and progression may be complex functions of interactions among the temperament dimensions. The antisocial temperament type or configuration (i.e., high novelty seeking, low harm avoidance, and low reward dependence) facilitates early onset according to these data as well as other prospective studies (Cloninger et al. 1988a) and cross-sectional studies of adolescents (Wills et al. 1994). In contrast, the risk of severity in the progression of problems is increased by both high novelty seeking and high harm avoidance in these data, and in studies of severe alcoholics in treatment (Nixon and Parsons 1990).

These findings support the view that heritable temperament dimensions influence the initiation of any drinking, continuation of frequent drinking, and cessation of alcohol abuse. It is important to distinguish these phases of drinking, because harm avoidance has different effects on starting and stopping alcohol abuse. This is comparable to observations that novelty seeking is associated with the initiation of cigarette smoking, whereas harm avoidance is associated with difficulty stopping cigarette smoking (Pomerleau et al. 1992; Menza et al. 1993).

In view of other findings that the four temperaments are independently inherited dimensions of personality, these data explain the observation of symptom complexes or subtypes that can be distinguished in their personality profile, age of onset, gender, and alcohol-related symptoms (Cloninger et al. 1981; Babor et al. 1982; Litt et al. 1992). Because the temperaments are independently inherited but risk depends on the configuration of multiple temperaments, extensive clinical and etiological heterogeneity is expected in alcoholics.

This modern view supports the description of alcoholism by Kraepelin based on his observations approximately a century ago. Kraepelin described disorders in terms of a medical model, but viewed them etiologically and clinically in terms of interactions among multiple quantitative dimensions. Nonlinear interactions make it useful to distinguish types of disorder, which differ in terms of symptoms, course, etiology, and treatment. However, underlying dimensions of predisposition are quanti-

tative variables. Modern research is still trying to relate symptom complexes to such personality dimensions and, in turn, personality dimensions to the functions of their underlying brain processes.

## References

- Barbor TF, Hofmann M, DelBoca FK, Hesselbrock V, Meyer RE, Dolinsky ZS, Rounsaville B (1992) Types of alcoholics, I. Evidence for an empirically derived typology based on indicators of vulnerability and severity. *Arch Gen Psychiatry* 49:599-608
- Cloninger CR (1987a) Neurogenetic adaptive mechanisms in alcoholism. *Science* 236:410-416
- Cloninger CR (1987b) A systematic method for clinical description and classification of personality variants. *Arch Gen Psychiatry* 44:573-588
- Cloninger CR (1990) Genetic epidemiology of alcoholism: observations critical in the design and analysis of linkage studies. In: Cloninger CR, Begleiter H (eds) *Genetics and biology of alcoholism*. Banbury Report 33, Cold Spring Harbor Laboratory Press, pp 105-136
- Cloninger CR, Bohman M, Sigvardsson S (1981) Inheritance of alcohol abuse: cross-fostering analysis of adopted men. *Arch Gen Psychiatry* 38:861-868
- Cloninger CR, Przybeck TR, Svrakic DM (1991) The Tridimensional Personality Questionnaire: U.S. normative data. *Psychol* 69:1047-1057
- Cloninger CR, Sigvardsson S, Bohman M (1988a) Childhood personality predicts alcohol abuse in young adults. *Alcoholism* 12:494-505
- Cloninger CR, Sigvardsson S, Knorrning A-L von, Bohman M (1988b) The Swedish Studies of the adopted children of alcoholics. *J Stud Alcohol* 49:516-521
- Cloninger CR, Stallings MC (1995) Carving nature at its joints: the causal architecture of psychopathology. *Arch Gen Psychiatry* (in press)
- Cloninger CR, Svrakic DM, Przybeck TR (1993) A psychobiological model of temperament and character. *Arch Gen Psychiatry* 50:975-990
- Gilligan SB, Reich T, Cloninger CR (1987) Etiologic heterogeneity in alcoholism. *Genet Epidemiol* 4:395-414
- Gilligan SB, Reich T, Cloninger CR (1988) Alcohol-related symptoms in heterogeneous families of hospitalized alcoholics. *Alcoholism* 12:671-678
- Heath AC, Cloninger CR, Martin NG (1994) Testing a model for the genetic structure of personality: a comparison of the personality systems of Cloninger and Eysenck. *J Pers Soc Psychol* 66:762-775
- Helzer JE, Burnam A, McEvoy LT (1991) Alcohol abuse and dependence. In: Robins LN, Regier DA (eds) *Psychiatric disorders in america: the Epidemiologic Catchment Area Study*. Free Press, New York, pp 81-115
- Kraepelin E (1904) *Lehrbuch der Psychiatrie* (7th German edn, translated and adapted by A. Ross Diefendorf). Clinical psychiatry: a textbook of students and physicians, 1907. Reprinted with an introduction by Eric T. Carlson, 1981. Scholars' facsimiles and reprints, Delmar, NY, 1981
- Kraepelin E (1883) *Compendium der Psychiatrie: Fuer Gebrauche fuer Studierende und Aerzte*. Ambr Abel, Leipzig, pp xii and 384
- Litt MD, Babor TF, DelBoca KF, Kadden RM, Conney NL (1992) Types of alcoholics, II. Application of an empirically derived typology to treatment matching. *Arch Gen Psychiatry* 49:609-614
- Menza MA, Forman NE, Sage JI, Golbe LI (1993) Parkinson's disease and smoking: the relationship to personality. *Neuropsychiatr Neuropsychol Behav Neurol* 6:214-218
- Nixon SJ, Parsons OA (1990) Application of the tridimensional personality theory to a population of alcoholics and other substance abusers. *Alcoholism* 14:513-517

- Pomerleau CS, Pomerleau OF, Flessland KA, Basson SM (1992) Relationship of Tridimensional Personality Questionnaire scores and smoking variables in female and male smokers. *J Subst Abuse* 4:143-154
- SAS Institute Inc (1989) SAS/STAT User's Guide. Release 6.03 edn. SAS Institute, Cary, NC, 1028 pp
- SAS Institute Inc (1992) SAS Technical Report P-229, SAS/STAT Software: Changes and Enhancements, Release 6.07. SAS Institute, Cary, NC, 620 pp
- Selzer ML, Vinokur A, van Rooijen L (1975) A self-administered short Michigan Alcoholism Screening Test (SMAST). *J Stud Alcohol* 36:117-126
- Sigvardsson S, Bohman M, Cloninger CR (1987) Structure and stability of childhood personality: prediction of later social adjustment. *J Child Psychol Psychiatry* 38:929-946
- Stallings MC, Hewitt JK, Cloninger CR, Heath AC, Eaves LJ (1995) Genetic and environmental structure of the Tridimensional Personality Questionnaire. *J Pers Soc Psychol* (in press)
- Svrakic DM, Whitehead C, Przybeck TR, Cloninger CR (1993) Differential diagnosis of personality disorders by the seven factor model of temperament and character. *Arch Gen Psychiatry* 50:991-999
- Tremblay RE, Pihl RO, Vitaro F, Dobkin PL (1994) Predicting early onset of male antisocial behavior from preschool behavior. *Arch Gen Psychiatry* 54:732-739
- Wills TA, Vaccaro D, McNamara G (1994) Novelty seeking, risk taking, and related constructs as predictors of adolescent substance use: an application of Cloninger's theory. *J Subst Abuse* 6:1-20
- Wundt W (1903) Characteristics of physiological psychology, vol 3, 5th edn. W Engelmann, Leipzig