

A longitudinal study of drug and alcohol use by psychosis-prone and impulsive-nonconforming individuals.

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Abstract:

The rates of substance use and abuse are higher among psychotic patients and antisocial individuals than in the general population. In a 10-year longitudinal study, psychosis-prone individuals identified by the Perceptual Aberration (L. J. Chapman, J. P. Chapman, M. L. Raulin, 1976) and Magical Ideation (Per-Mag) scales (M. Eckblad & L. J. Chapman, 1983), and individuals with antisocial traits, identified by the Impulsive Nonconformity (Noncon) scale (L. J. Chapman et al., 1984), exceeded a control group on rates of substance use disorders. As hypothesized, the Per-Mag group demonstrated preferential patterns of substance use similar to those reported for schizophrenic patients. Participants who scored deviantly on both the Per-Mag and Noncon scales were at especially heightened risk for substance use disorders. Psychosis proneness at the initial screening predicted substance abuse at the follow-up evaluation, but substance abuse at the initial interview did not predict later clinical psychosis or psychoticlike experiences.

Keywords: antisocial behavior | nonconformity | personality | psychosis | longitudinal studies | psychosis proneness | substance abuse | college students | psychology

Article:

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The rates of psychoactive substance use and abuse are higher among psychotic patients than the general population. The recent Epidemiological Catchment Area (ECA) study (Regier et al., 1990) reported that the odds of meeting criteria for a substance abuse disorder are 4.6 times as high for individuals diagnosed with schizophrenia than for the general population. Schizophrenic patients are six times as likely as the general population to develop a drug use disorder and three times as likely to develop an alcohol use disorder. Similarly for bipolar disorder, the odds for developing a substance abuse disorder are 7.9 times greater than in the general population.

In addition to the general findings of increased substance use and abuse by schizophrenic patients, studies have assessed the specific preferences and patterns of substance use by schizophrenic patients. Schneier and Siris (1987) and Mueser et al. (1990) provided methodologically sophisticated and exhaustive reviews of studies that compared the use of illicit drugs and alcohol by schizophrenic patients with normal and psychiatric control groups. Both reviews concluded that schizophrenic patients choose substances for abuse in a nonrandom manner. Mueser et al. (1990) found that schizophrenic patients abuse stimulants (such as amphetamines and cocaine) significantly more than control group participants and may be more likely to abuse hallucinogens and cannabis than either psychiatric or normal control participants. Schizophrenic patients were not more likely to abuse alcohol, sedatives, or narcotics than control group participants. Similarly, Schneier and Siris (1987) found that participants with schizophrenia exceeded control group participants on the use and abuse of amphetamines, cocaine, cannabis, and hallucinogens. Use of alcohol, sedatives, and opiates by schizophrenic participants did not exceed that of the control group participants.

The preferential use of stimulants and hallucinogens by schizophrenic patients seems counterintuitive because these substances have been reported to precipitate or exacerbate psychotic symptoms (Bowers, 1972 , 1977; Hall, Popkin, Beresford, & Hall, 1988). However, Schneier and Siris (1987) and Dixon, Haas, Weiden, Sweeney, and Francis (1990) suggested that patients may use these substances to counteract negative symptoms or the effects of neuroleptic medications. The conclusions by Mueser et al. (1990) and Schneier and Siris (1987) concerning alcohol use appear in direct contrast to the epidemiological data of Regier et al. (1990) , which indicate that schizophrenic individuals abuse alcohol more than the general population. However, these differences may have resulted from differences in sampling strategies.

Psychosis Proneness

Many current investigations of schizophrenia and affective psychoses follow a diathesis–stress model, which assumes that these psychoses arise from the interaction of environmental stress with a predisposition or proneness. Examples of such a model for schizophrenia include work by

Meehl (1973 , 1990) and Gottesman (1991). The diathesis–stress model implies that there are psychosis-prone individuals who carry the predisposition but who do not decompensate into clinical psychosis. In fact, the majority of psychosis-prone individuals are not expected to decompensate, but they may demonstrate mild and transient forms of the experiences and symptoms displayed by psychotic patients. Identification of psychosis-prone individuals would facilitate the study of relevant biological and environmental etiological factors and the development of treatment interventions. The present study examines the diatheses, but not specifically the environmental stresses, that lead to substance abuse in psychosis-prone individuals.

Psychosis Proneness and Substance Abuse

The investigation of substance abuse by psychosis-prone individuals who have not yet developed a psychotic disorder provides an advantage over studies using clinical patients. This method provides an opportunity to examine the development of both substance abuse and psychosis. Despite the reports that schizophrenic patients are at heightened risk for developing substance abuse, studies examining the relationship between psychosis proneness and substance abuse are limited and have primarily examined substance use by patients with personality disorders, such as schizotypal, schizoid, paranoid, and borderline, that are associated with psychotic disorders.

Bornstein, Klein, Mallon, and Slater (1988) reported that outpatients with schizotypal personality disorder exceeded psychiatric outpatient control group participants on drug abuse but not alcohol abuse. They added that all of the schizotypal participants experienced the onset of schizotypal symptoms prior to the onset of drug or alcohol use disorders.

Most studies of individuals presumed to be at high risk for psychoses examined the offspring of schizophrenic individuals and either have not reported data concerning substance abuse or involved individuals who had not reached adulthood. The remaining studies have provided an unclear picture of substance abuse by psychosis-prone individuals. Weintraub (1987) did not find differences in the overall rate of substance abuse between the 18-year-old offspring of schizophrenic individuals and control group participants. Although numerous studies have reported excessive substance abuse by high scorers on the Eysenck and Eysenck (1975) Personality Questionnaire Psychoticism scale (e.g., Rankin, Stockwell, & Hodgson, 1982), the scale does not appear to measure psychosis proneness (Chapman, Chapman, & Kwapil, 1994; Davis, 1974).

Possible Relationships of Psychosis Proneness and Substance Abuse

Turner and Tsuang (1990) and Drake et al. (1990) concluded that substance abuse in schizophrenia is associated with earlier onset, exacerbation of symptoms, and poorer prognosis. Therefore, if psychosis-prone individuals are, in fact, at increased risk for alcohol and drug abuse, the substance abuse may in turn increase the likelihood of the onset of psychotic symptoms. In contrast, Dixon, Haas, Weiden, Sweeney, and Francis (1991) suggested that

schizophrenic patients who abuse drugs tend to have less severe symptoms and better prognoses than non-drug-abusing schizophrenic patients. They added, however, that drug abuse may complicate an “otherwise less severe case of schizophrenia” (p. 227). Similarly, Mueser et al. (1990) reported that cannabis use by schizophrenic patients was associated with fewer symptoms and hospitalizations. They suggested that more socially competent patients were prone to cannabis use.

The temporal relationship of substance abuse with psychotic illnesses and psychosis proneness is not entirely clear. Turner and Tsuang (1990) and Dixon et al. (1990) reviewed several models of this relationship. Freed (1975) hypothesized that alcohol abuse typically develops subsequent to schizophrenia and tends to mask psychotic symptoms, so that problems with alcohol, but not psychotic symptoms, are detected. Schneier and Siris (1987) and Siris et al. (1988) suggested that psychotic patients may use drugs to medicate themselves, whereas Treffert (1978) hypothesized that psychotic patients may use drugs to contend with social isolation. Conversely, McLellan, Woody, and O'Brien (1979) and Bowers (1987) hypothesized that drug use may play an etiological role in the development of psychosis for a subgroup of patients.

Measurement of Psychosis Proneness

The Chapmans and their collaborators developed a series of self-report questionnaires designed to measure symptoms and traits reported to be characteristic of proneness to schizophrenia or psychosis. Their choice of traits relied primarily on Meehl's (1964) description of schizotypy and Hoch and Cattell's (1959) description of pseudoneurotic schizophrenia. These measures included the Perceptual Aberration Scale (PerAb; Chapman, Chapman, & Raulin, 1978), the Magical Ideation Scale (MagicId; Eckblad & Chapman, 1983), the Impulsive–Nonconformity Scale (Noncon; Chapman et al., 1984), and the Revised Physical Anhedonia Scale (PhyAnh; Chapman, Chapman, & Raulin, 1976). Recent evidence indicates that whereas PerAb and MagicId do measure psychosis proneness, Noncon and PhyAnh do not (Chapman, Chapman, Kwapil, Eckblad, & Zinser, 1994). Individuals who score deviantly on either the PerAb or the MagicId scale are typically combined into a single (Per–Mag) group, because the scales are highly correlated (Chapman, Chapman, & Miller, 1982).

Relationships Between Substance Abuse and Traits Measured by the Chapman Scales

Relationship of Per–Mag Traits and Substance Use

The PerAb and MagicId scales measure schizophreniclike beliefs and perceptual experiences. There is a well-established literature describing the positive association between such psychotic and psychoticlike experiences and substance abuse (Bowers, 1972, 1987; Mueser et al., 1990).

Relationship of Noncon Traits and Substance Abuse

The association between nonconforming, antisocial behaviors and substance abuse has been well established (Grande, Wolf, Schubert, Patterson, & Brocco, 1984 , and Smith & Newman, 1990 , provide reviews of this literature). The third revised Diagnostic and Statistical Manual of Mental Disorders (DSM–III–R; American Psychiatric Association, 1987) indicated that substance use often begins unusually early for individuals with antisocial personality disorder. The odds of developing a substance abuse disorder are 29.6 times greater for individuals diagnosed with antisocial personality disorder than in the general population (Regier et al., 1990). Moreover, nonconforming and antisocial behaviors in childhood, adolescence, and young adulthood are predictive of later substance abuse problems (Robins & Price, 1991; Tarter, 1988; Windle, 1990; Zucker & Gomberg, 1986).

Relationship of Physical Anhedonia and Substance Abuse

The relationship between anhedonia and substance abuse has not received much attention. However, studies do not suggest increased rates of substance use or abuse by schizoid patients, who might be suspected to be anhedonic (Drake, Adler, & Vaillant, 1988; Drake & Vaillant, 1985). Individuals who score deviantly on the PhyAnh scale endorse items that indicate a lack of sensation seeking and a lack of sensory pleasure. Therefore, these individuals are not expected to be at a heightened risk for substance abuse.

Longitudinal Study of Individuals Identified by the Chapman Scales

College students who scored deviantly on the Chapmans' scales and control group participants were selected as part of a longitudinal study investigating psychosis proneness (a full description of the studies is available in Chapman & Chapman, 1987 , and Chapman, Chapman, Kwapil, Eckblad, & Zinser, 1994). However, the participants were also evaluated on a variety of other psychosocial measures, including drug and alcohol use. They were interviewed at the time of selection and at 2-year and 10-year follow-up evaluations.

Psychosis Proneness at the 10-Year Follow-Up

The PerAb and MagicId scales were effective predictors of psychosis proneness at the 10-year follow-up (Chapman, Chapman, Kwapil, Eckblad, & Zinser, 1994). The Per–Mag group exceeded the control group on the proportion of individuals who developed clinical psychosis during the follow-up period, proportion of individuals with psychotic relatives, and the severity of psychoticlike and schizotypal experiences. Per–Mag individuals who reported moderately psychoticlike experiences at the initial evaluation were found to be especially deviant on the measures of psychosis and psychosis proneness at the follow up. Neither the Noncon or the PhyAnh scales were effective predictors of psychosis proneness at the 10-year assessment. Both Per–Mag and Noncon individuals were poorer on overall functioning.

Substance Use at the Initial Interview

Male and female Noncon participants exceeded control group participants on drug use and alcohol use at the initial interview. Among the Per–Mag participants, women but not men exceeded control group participants on drug use (Chapman & Chapman, 1987). However, the investigators did not report comparisons on substance abuse, separate comparisons for current and heaviest use–abuse, or breakdown of use–abuse by specific classes of drugs.

Investigation of Drug and Alcohol Use at the 10-Year Follow-Up Evaluation

Although this investigation was not developed specifically to assess drug and alcohol abuse, it generally adheres to the methodological refinements suggested by Mueser et al. (1990) for assessing substance abuse. These include the following: (a) using standardized instruments to diagnose psychopathology and substance abuse, (b) evaluating current and past abuse, (c) assessing substance abuse in a variety of groups, (d) matching groups on demographic variables, and (e) assessing abuse of specific classes of substances. Mueser et al. (1990) also recommended using multiple sources of information to assess substance abuse, although it was not feasible in this study.

Specific Hypotheses of the Present Study

The present study examines the longitudinal relationship between psychosis proneness and substance abuse. Specifically, this study investigates whether psychosis proneness, as measured by the Per–Mag scale, predicted substance use disorders at the 10-year follow-up evaluation, and whether substance use disorders diagnosed at the initial evaluation predicted psychosis and psychosis proneness 10 years later. The study also examines the relationship between antisocial, nonconforming traits, as measured by the Noncon scale, and substance abuse. On the basis of increased risk of substance use and abuse by psychotic and antisocial patients, it was hypothesized that Per–Mag and Noncon participants would have greater rates of substance use and a larger proportion of participants with substance use disorders than control group participants. Those who qualified for both the Per–Mag and Noncon groups were expected to be at an especially heightened risk. PhyAnh participants were not expected to be at an increased risk for substance abuse, given their lack of pleasure and sensation seeking and the findings by Chapman, Chapman, Kwapil, Eckblad, and Zinser (1994) that PhyAnh participants were not psychosis prone.

This study also investigated whether psychosis-prone participants demonstrated patterns of drug preference similar to those reported by psychotic patients. Specifically, it was hypothesized that the Per–Mag individuals would show heightened rates of cocaine, amphetamine, cannabis, and hallucinogen use and abuse relative to control group participants, consistent with the findings for schizophrenic patients reported by Schneier and Siris (1987) and Mueser et al. (1990). It was further hypothesized that participants who reported heavy substance use at the initial evaluation would demonstrate heightened rates of substance use disorders at the follow-up evaluation. The study also explored whether participants who reported substance use disorders at the initial

evaluation were at greater risk for developing depression, criminal behavior, and relationship problems at the 10-year follow-up.

Method

Participants

The four Chapman questionnaires were administered to approximately 8,000 undergraduate students enrolled in introductory psychology courses at the University of Wisconsin—Madison during the late 1970s and early 1980s. Students who received a standard score of at least 1.96 on the PhyAnh, PerAb, MagicId, or Noncon scales were invited to participate in the study. Fourteen students whose combined z scores on the PerAb and MagicId scales were 3.0 or greater were included in the Per–Mag group, even though they did not have z scores of 1.96 or greater for either individual scale. An additional group of students did not score deviantly on the PerAb, MagicId, PhyAnh or Noncon scales but had a combined z score on the four scales of at least 2.75 (the combined score group). This group was included at the recommendation of a grant review panel as a test of the hypothesis that a combination of these traits predicts psychosis. Of the entire sample, 2% met the criteria for the combined score group without qualifying for any other high-risk group. Students whose scores were less than 0.5 standard deviations above the mean on each of the four scales were selected as control group participants; they did not differ from students in the high-risk groups on age, education, or father's social position.

High-risk participants could have elevated scores on more than one psychosis-proneness scale and thereby qualify for more than one high-risk group. Primary group designation was determined by assigning high-risk participants to only one group on the basis of their highest z score. “All-inclusive” groups were formed by assigning participants to every high-risk group for which they qualified. Control and combined score participants could only have primary group membership, because they did not score deviantly on any of the scales. Table 1 presents the number of participants in each primary and all-inclusive group at the time of the initial testing and the number of participants reinterviewed at the 10-year follow-up evaluation. Thirty-four participants initially qualified for both the Per–Mag and the Noncon group (33 were reinterviewed at the 10-year follow-up), and 2 participants qualified for both the PhyAnh and Noncon groups (1 was reinterviewed). At the follow-up assessment, women comprised 53% of the Per–Mag, 65% of the Noncon, 41% of the PhyAnh, 59% of the combined score, and 47% of the control group.

Table 1
Number of Participants by Groups at the Initial and 10-Year Follow-Up Evaluations

Group	Primary group		All-inclusive group	
	Initial testing	10-year follow-up	Initial testing	10-year follow-up
Per-Mag	193	182	203	191
Noncon	74	71	100	96
PhyAnh	75	70	75	70
Combined score	33	32		
Control	159	153		
Total	534	508		

Note. Per-Mag = Perceptual Aberration-Magical Ideation; Noncon = Impulsive Nonconformity; PhyAnh = Physical Anhedonia; combined score = participants who did not qualify for any high-risk group but who were deviant on the sum of the scores for the four scales; Primary = assignment of participants to experimental groups on the basis of their highest scale z score; all-inclusive = assignment of participants to every experimental group for which they qualify.

Number of Participants by Groups at the Initial and 10-Year Follow-Up Evaluations

We were able to locate and reinterview 508 (245 men, 263 women) of the original sample of 534 students (254 men, 280 women), a 95% success rate. The reinterview rate did not differ between the groups. The reinterviewed participants did not differ from the individuals who were lost to attrition on father's social position or measures of substance use or abuse at the initial interview. The follow-up interviews were completed 8.8 to 14.5 years after the initial testing ($M = 10.7$ years, $SD = 1.0$ years). The participants' ages at the follow-up evaluation ranged from 27.8 to 39.4 years old ($M = 30.0$ years, $SD = 1.7$ years). The groups did not differ on either the mean interval between testing or mean age of the participants at the follow-up. The participants resided throughout the United States and on five continents at the time of the follow-up interview.

Of the 508 participants who were reinterviewed, 506 were assessed in person, and 2 were interviewed by telephone. Three died between the time of the initial and the follow-up evaluations. The remaining 19 were not located or refused to participate. The individuals initially participated in the study for credit in their introductory psychology course and were paid for their participation during subsequent evaluations.

Materials

Initial evaluation

The 534 individuals who originally agreed to participate in the study were administered a comprehensive diagnostic interview following the mass screening. The interview consisted of a modified version of the Schedule for Affective Disorders and Schizophrenia—Lifetime Version (SADS–L; Spitzer & Endicott, 1977), which included additional questions pertaining to

schizotypal and psychoticlike experiences. The interview assessed social and educational functioning, mood and anxiety disorders, psychosis, mental health treatment, and drug and alcohol use. Psychotic and psychoticlike experiences were rated at both assessments using Chapman and Chapman's (1980) manual, which provides 11-point scales of deviancy for assessing such experiences.

Ten-year follow-up evaluation

The follow-up interview consisted of a modified version of the SADS-L (Spitzer & Endicott, 1977) and the portions of Loranger's (1988) Personality Disorder Exam (PDE) that assess schizotypal, schizoid, and paranoid personality disorder. Participants were also evaluated on two measures of overall functioning: the Hollingshead (1957) Two-Factor Index of Social Position (socioeconomic status, or SES) and the Global Adjustment Scale (GAS; Endicott, Spitzer, Fleiss, & Cohen, 1976). The SES is a weighted composite measure of education and occupation (with higher scores indicating lower SES). The GAS is a rating of overall adjustment ranging from severe psychopathology requiring constant supervision (low scores) to superior functioning in most areas of life (high scores).

Measures of substance abuse

The participants were assessed for DSM-III-R (American Psychiatric Association, 1987) substance abuse and dependence at the initial interview and the 10-year follow-up for alcohol, cannabis, cocaine, amphetamines, sedatives, hallucinogens, and opioids. (Information from the initial interview was used to diagnose DSM-III-R substance use disorders occurring at the time of the initial interview. These diagnoses were made after the completion of the 10-year follow-up by raters who were unaware of the participants' substance use at the follow-up evaluation.) The assessment of drug and alcohol use was based on self-report. Needle, Jou, and Su (1989) and Single, Kandel, and Johnson (1975) provided empirical evidence that self-report measures of substance use provide valid information.

Participants were rated following both interviews on the frequency of current and heaviest alcohol usage on a scale from 0 (none) to 5 (more than 3 times per week), and on the quantity of alcohol consumed per day on a scale from 0 (none) to 4 (more than 8 beers or 5 mixed drinks). The product of frequency and quantity (score of 0 to 20) produced measures of current and heaviest usage of alcohol. The participants were rated on current and greatest impairment in functioning caused by alcohol use on a scale from 1 (none) to 6 (major life disruptions, such as loss of job, end of marriage, or life threatening health problems).

Participants were rated on current and heaviest drug use separately on scales ranging from 0 (none) to 4 (excessive use) for cannabis, amphetamines, and sedatives; from 0 (none) to 6 (excessive use) for cocaine and hallucinogens; and from 0 (none) to 8 (weekly use) for opioids. The rating scales reflected frequency and quantity of use, and they differed to reflect the seriousness of different substances. The ratings for each substance were summed to produce

measures of current and heaviest drug use (scores of 0 to 32). Likewise, the participants were rated on current and highest impairment in functioning caused by drug use on a scale from 1 (none) to 6 (major life disruptions). The impairment score and the largest drug use score were converted to standard scores and summed to produce composite measures of current and highest drug interference (scores of 1 to 14). Whereas the primary measures of interest were the DSM–III–R (American Psychiatric Association, 1987) diagnoses of substance abuse and dependence, these ratings provided quantitative measures of substance use and impairment.

The interviews, scoring, and diagnosis at the initial and follow-up evaluations were conducted by clinical psychologists and advanced psychology graduate students who had received extensive training in diagnosis and assessment. The interviews were audio taped, and portions were typed to facilitate scoring and diagnosis. The interviewers and scorers were not aware of the participants' group membership. All diagnoses were made according to DSM–III–R criteria (American Psychiatric Association, 1987).

Statistical Method

Conventional analysis of variance (ANOVA) was used to compare the groups when quantitative data were analyzed. The Brown–Forsythe statistic (F^*) was computed when the assumption of homogeneity of variance among groups was violated. In keeping with the original hypotheses of the study; statistical analyses were limited to comparisons of each experimental group with the control group and did not include comparisons across experimental groups. Therefore; Dunnett's t statistic was computed to control for familywise error. Separate variance t statistics were computed when the assumption of homogeneity of variance was violated. Fisher's Exact test was reported for 2×2 contingency tables. Results were reported for the all-inclusive groups only if they differed in significance from the results for the primary groups.

Results

Substance Use at the 10-Year Follow-Up

Overall rates of DSM–III–R (American Psychiatric Association, 1987) substance use disorders

Table 2 presents the proportion of male and female participants in each group who qualified for at least one DSM–III–R substance use disorder diagnosis at any time during the 10-year follow-up period. The Per–Mag and Noncon groups both differed significantly from the control group, Fisher's Exact test, $p < .01$. These findings were not substantively changed when the 14 individuals who were diagnosed with psychosis at the follow up were omitted from the analyses. Collapsing across group membership, the male participants more often received substance abuse and dependence diagnoses than the female participants (33% to 19%, respectively), Fisher's Exact test, $p < .01$. The experimental groups were also compared with the control group on rates of substance use disorders separately for men and women. The male and female Noncon and Per–Mag groups each differed from their respective control groups. The PhyAnh and combined

score groups did not differ from the control group. Because the comparisons combining genders did not differ substantively from those computed for men and women separately, subsequent analyses were simplified by combining genders.

Table 2
Percentage of Participants in Each Group Who Received at Least One DSM–III–R Substance Use Disorder Diagnosis at Any Time During the 10-Year Follow-up Period

Participants	Group				
	Per-Mag (n = 182)	Noncon (n = 71)	PhyAnh (n = 70)	Combined score (n = 32)	Control (n = 153)
Total	32**	37**	14	18	18
Men	40*	52*	17	39	26
Women	26**	28**	10	11	10

Note. DSM–III–R = *Diagnostic and Statistical Manual of Mental Disorders* (3rd ed., rev.; American Psychiatric Association, 1987); Per-Mag = Perceptual Aberration-Magical Ideation; Noncon = Impulsive nonconformity; PhyAnh = Physical Anhedonia; combined score = participants who did not qualify for any high-risk group but who were deviant on the sum of the scores for the four scales. Fisher's exact test comparisons were used with the control group.
 * $p < .05$. ** $p < .01$.

Percentage of Participants in Each Group Who Received at Least One DSM–III–R Substance Use Disorder Diagnosis at Any Time During the 10-Year Follow-Up Period

Alcohol use at 10-year follow-up

Participants were assessed for DSM–III–R (American Psychiatric Association, 1987) alcohol abuse and dependence, which occurred during the 10-year follow-up period. Table 3 includes the percentage of participants in each group who received such diagnoses. Both the Per–Mag and Noncon groups exceeded the control group, Fisher's Exact test, $p < .01$. The PhyAnh and combined score groups did not differ from the control group.

Table 3
Percentage of Participants in Each Group Who Qualified for DSM-III-R Substance Use Disorder Diagnoses at Any Time During the 10-Year Follow-up Period

Substance	Group				
	Per-Mag (n = 182)	Noncon (n = 71)	PhyAnh (n = 70)	Combined score (n = 32)	Control (n = 153)
Alcohol	22.0**	30**	11	22	12
Cannabis	14*	13*	4	13	7
Cocaine	7	7	3	3	3
Amphetamines	6*	4	0	0	1
Sedatives	1	1	0	0	1
Hallucinogens	1	0	0	0	0
Opioids	0	0	0	0	1

Note. DSM-III-R = Diagnostic and Statistical Manual of Mental Disorders (3rd ed., rev.; American Psychiatric Association, 1987). Per-Mag = Perceptual Aberration-Magical Ideation; Noncon = impulsive nonconformity; PhyAnh = Physical Anhedonia; combined score = participants who did not qualify for any high-risk group but who were deviant on the sum of the scores for the four scales. Fisher's Exact test comparisons were used with the control group.

* $p < .05$. ** $p < .01$.

Percentage of Participants in Each Group Who Qualified for DSM-III-R Substance Use Disorder Diagnosis at Any Time During the 10-Year Follow-Up Period

The groups were compared on the 20-point measures of current and heaviest alcohol use during the last 10 years. The groups differed on heaviest alcohol use, $F(4, 503) = 4.56, p < .005$. The Noncon group exceeded the control group, $t(503) = 3.58, p < .01$, whereas the Per-Mag group marginally exceeded the control group, $t(503) = 2.30, p < .10$. The all-inclusive Per-Mag group differed from the control group, $t(342) = 2.44, p < .05$. The groups did not differ on current alcohol usage, although the all-inclusive Noncon group exceeded the control group, separate-variance $t(183) = 2.52, p < .01$, and the all-inclusive Per-Mag group marginally exceeded the control group, separate-variance $t(338) = 1.72, p < .10$.

The groups differed on the 6-point rating scale of heaviest impairment caused by alcohol use during the 10-year follow-up period, $F^*(4, 316) = 4.69, p < .01$. The Noncon group exceeded the control group, separate-variance $t(112) = 3.84, p < .01$, whereas the Per-Mag group marginally exceeded the control group, separate-variance $t(332) = 2.02, p < .10$. The all-inclusive Per-Mag group also differed from the control group, separate-variance $t(341) = 2.61, p < .01$. The groups did not differ on the rating of current alcohol impairment.

Overall measures of drug use at 10-year follow-up

The groups differed on the measure of heaviest use, $F^*(4, 300) = 9.49, p < .001$. The Per-Mag and Noncon groups exceeded the control group, separate-variance $t(331) = 4.26, p < .01$, and

separate-variance $t(109) = 3.70, p < .01$, respectively. The groups likewise differed on current overall use at the time of the 10-year evaluation, $F^*(4, 107) = 4.13, p < .01$. Both the Per–Mag and Noncon groups exceeded the control group, separate-variance $t(317) = 2.92, p < .05$, and separate-variance $t(82) = 2.85, p < .05$, respectively.

The groups differed on the 6-point rating scale of heaviest impairment caused by drug use during the 10-year follow-up period, $F^*(4, 383) = 11.17, p < .001$. Both the Per–Mag and Noncon groups exceeded the control group, separate-variance $t(331) = 4.04, p < .01$, and separate-variance $t(144) = 3.38, p < .01$, respectively. The groups also differed on current drug impairment at the time of the 10-year follow-up, $F^*(4, 182) = 4.75, p < .01$. Both the Per–Mag and Noncon groups exceeded the control group, separate-variance $t(313) = 3.36, p < .01$, and separate-variance $t(94) = 2.80, p < .05$, respectively.

The groups differed on the score for heaviest drug interference, $F(4, 503) = 12.34, p < .001$. Both the Per–Mag and Noncon groups exceeded the control group, $t(503) = 4.99, p < .01$, and $t(503) = 4.07, p < .01$, respectively. The groups also differed on current drug interference, $F^*(4, 160) = 5.03, p < .001$. Both the Per–Mag and Noncon groups exceeded the control group, separate-variance $t(320) = 3.30, p < .01$, and separate-variance $t(96) = 2.87, p < .05$, respectively.

Amphetamine use at 10-year follow-up

The Per–Mag group, as well as the all-inclusive Noncon group, exceeded the control group on the proportion of participants who qualified for amphetamine abuse or dependence diagnoses, Fisher's Exact test, $p < .05$, for both analyses. The other groups did not differ from the control group. The groups differed on heaviest amphetamine use during the 10-year follow-up period, $F^*(4, 357) = 2.63, p < .05$. The Per–Mag and Noncon groups marginally exceeded the control group, separate-variance $t(328) = 2.20, p < .10$, and separate-variance $t(108) = 2.26, p < .10$, respectively. The all-inclusive Per–Mag and Noncon groups significantly exceeded the control group on heaviest amphetamine use, separate-variance $t(339) = 2.46, p < .01$, and separate-variance $t(147) = 3.42, p < .01$, respectively. The groups marginally differed on current amphetamine use at the time of the 10-year evaluation, $F^*(4, 103) = 2.36, p < .10$. None of the comparisons of the primary groups were significant. However, the all-inclusive Per–Mag group exceeded the control group, separate-variance $t(216) = 1.99, p < .05$, whereas the all-inclusive Noncon group marginally exceeded the control group, separate-variance $t(99) = 1.93, p < .10$.

Cocaine use at 10-year follow-up

The all-inclusive Noncon group exceeded the control group, Fisher's Exact test, $p < .05$, on the proportion of participants diagnosed with cocaine abuse or dependence. The other groups did not differ from the control group. The groups differed on the rating of heaviest cocaine use, $F^*(4, 213) = 7.67, p < .001$. The Per–Mag and Noncon groups exceeded the control group, separate-variance $t(329) = 4.51, p < .01$, and separate-variance $t(113) = 3.59, p < .01$, respectively. The

groups also differed on current cocaine use, $F^* (4, 112) = 2.69, p < .05$. The Per–Mag and Noncon groups exceeded the control group, separate-variance $t (245) = 2.68, p < .05$, and separate-variance $t (77) = 2.60, p < .05$, respectively.

Sedative use at 10-year follow-up

None of the groups differed from the control group on the proportion of participants with sedative abuse or dependence diagnoses. Likewise, the groups did not differ on ratings of heaviest or current sedative use.

Cannabis use at 10-year follow-up

The Per–Mag group exceeded the control group on the proportion of participants receiving diagnoses of cannabis abuse or dependence, Fisher's Exact test, $p < .05$. The all-inclusive Noncon group exceeded the control group, $p < .05$. The groups differed on heaviest cannabis use, $F^* (4, 325) = 13.91, p < .001$. Both the Per–Mag and Noncon groups exceeded the control group, separate-variance $t (327) = 4.48, p < .01$, and separate-variance $t (132) = 4.40, p < .01$, respectively. Likewise, the groups differed on current cannabis use, $F^* (4, 172) = 4.85, p < .01$. Both the Per–Mag and Noncon groups exceeded the control group, separate-variance $t (302) = 3.05, p < .01$, and separate-variance $t (94) = 2.77, p < .05$, respectively.

Hallucinogen use at 10-year follow-up

The groups did not differ on the proportion of participants with diagnoses of hallucinogen use disorders, but they differed on heaviest hallucinogen use, $F^* (4, 267) = 5.27, p < .001$. Both the Per–Mag and Noncon groups exceeded the control group, separate-variance $t (321) = 3.08, p < .01$, and separate-variance $t (101) = 2.93, p < .05$, respectively. The groups marginally differed on current hallucinogen use, $F^* (4, 79) = 2.23, p < .10$. However, none of the comparisons with the control group were significant.

Opioid use at 10-year follow-up

None of the groups differed on the proportion of participants with diagnoses of opioid abuse or dependence or on the ratings of heaviest or current opioid use.

Prediction of subsequent drug use by psychosis proneness

Psychosis proneness, as defined by membership in the Per–Mag group, predicted excessive drug and alcohol use at the 10-year follow up. However, Chapman and Chapman (1987) reported that the female Per–Mag students exceeded controls on drug use at the initial assessment. To determine whether the Per–Mag scale actually predicted change in drug use and impairment, or conversely whether differences between Per–Mag and control group members at the follow-up were simply the result of differences found at the initial interview, a two-way repeated measures ANOVA was computed comparing Per–Mag and control groups on the rating of drug

interference at the initial and 10-year interviews. Drug interference was used because it is a standardized, composite measure of both drug use and impairment. The means for the Per–Mag group at the initial and follow-up interviews were .37 and .50, respectively, whereas the means for the control group were –.44 and –.59, respectively. The interaction was significant, $F(1, 342) = 5.20, p < .05$, indicating that the Per–Mag group increased more than the control group on drug interference from the initial to follow-up assessments.

The relationship between substance use disorders and psychoticlike experiences at the 10-year follow up were also examined. Per–Mag group members were dichotomized on whether they met criteria for a substance use disorder during the follow-up period and whether they reported at least moderately psychoticlike experiences at the follow up. The phi coefficient, $r = .20, p < .01$, indicated a positive association between substance use disorders and psychoticlike experiences for the Per–Mag participants at the follow up. Thus, within a group of psychosis-prone individuals, a poorer clinical picture (as demonstrated by psychoticlike experiences) is associated with greater substance abuse–dependence.

Eight of the 14 participants diagnosed with a psychotic disorder at the 10-year follow-up also qualified for a substance use disorder at the follow-up evaluation. However, with the exception of one control group member, the drug or alcohol problems developed subsequent to the psychotic illness.

Substance Use by Individuals Identified by Both the Per–Mag and Noncon Scales

Participants who scored deviantly on both the Per–Mag and Noncon scales were the most deviant on measures of substance use and abuse. Fifty-eight percent of the high Per–Mag/Noncon participants met DSM–III–R (American Psychiatric Association, 1987) criteria for substance use disorder, significantly higher than the rate in the remaining Per–Mag participants (28%), Fisher's Exact test, $p < .01$, or in the remaining Noncon participants (35%), $p < .05$.

Effects of Noncon Score on Per–Mag Participants' Substance Use

Chapman et al. (1984) reported that the correlation between the Noncon and PerAb scales was .40 for men and .43 for women. All control group members had standardized Noncon scores of 0.5 or less (selection criteria), whereas Per–Mag group members were not constrained on Noncon score. To determine whether increased rates of substance use and abuse reported by Per–Mag group members were simply the result of Noncon traits, a subgroup of 33 Per–Mag participants was compared on substance use measures with a subgroup of 38 Noncon participants matched on mean, variance, and distribution of Noncon scores. Likewise, a subgroup of 70 Per–Mag and 77 control group members matched on Noncon scores were compared. The Per–Mag subgroup exceeded the matched Noncon subgroup on measures of substance use disorders and on overall ratings of drug and alcohol use. However, the Per–Mag and control subgroup matched on Noncon score did not differ on any of these measures.

Chapman, Chapman, Kwapil, Eckblad, and Zinser (1994) reported that Per–Mag group members were at heightened risk for psychosis and mood disorders. Additional analyses were computed to insure that the Per–Mag group's heightened rate of substance abuse was predicted by psychosis proneness and not general psychopathology. Per–Mag participants who reported marked symptoms of depression, mania, and anxiety at the initial assessment did not differ from remaining Per–Mag group members on rates of substance abuse at the follow up using Fisher's Exact test. Furthermore, Per–Mag participants who reported psychoticlike experiences at the follow-up (and therefore were presumed to be especially psychosis prone) but did not have mood disorders at the follow-up exceeded the control group on rates of substance abuse, Fisher's Exact test, $p < .01$.

Substance Use at the Initial Interview as a Predictor of Psychopathology at the 10-Year Follow-Up

Substance abuse by Per–Mag participants at the initial interview as a predictor of psychosis proneness

Psychosis proneness, as defined by membership in the Per–Mag group, was found to predict an increased risk of developing substance abuse. To determine whether substance abusers identified at the first interview were at an increased risk for developing psychosis, Per–Mag participants who were diagnosed with DSM–III–R (American Psychiatric Association, 1987) substance use disorders at the initial interview and Per–Mag students without such a diagnosis were compared on the proportion of students with clinical psychosis at the follow-up interview. They were also compared on ratings of psychoticlike experiences and on the PDE (Loranger, 1988) schizotypal dimensional score at the follow-up. None of the differences were significant, indicating that, whereas psychosis proneness predicted subsequent substance abuse disorders, substance abuse was not predictive of psychosis proneness or clinical psychosis.

Heavy substance use at the initial interview as a predictor of substance use disorders

In the entire sample, participants who reported heavy substance abuse at the initial interview were compared with the remaining participants on the proportion of participants who received at least one substance abuse or dependence diagnosis at the follow-up evaluation. Heavy substance use at the initial interview was defined by a score of 15 or above on the 20-point scale of alcohol use or a score of 8 or above on the 32-point scale of drug use. These cutoffs identified approximately 20% of the total sample. The participants who reported heavy substance use at the initial interview exceeded the remaining individuals on rate of substance use disorder diagnoses at the 10-year follow-up, Fisher's Exact test, $p < .001$. Altogether, 57% of individuals with an initial history of heavy substance use met criteria for a substance use disorder at the follow-up evaluation, compared to 18% of the remaining participants.

Substance abuse at the initial interview as a predictor of depression, criminal behavior, and overall functioning

The participants diagnosed with substance use disorders at the initial evaluation exceeded the remaining participants on the rate of major depression at the follow up, 35% to 24%, Fisher's Exact test, $p < .05$, and on proportion of individuals arrested during the follow-up period (excluding minor traffic tickets), 32% to 10%, $p < .001$. The substance abusers were also poorer on GAS rating, $t(504) = 4.45$, $p < .001$, and on attained social position, $t(508) = 3.14$, $p < .01$. Per–Mag individuals who qualified for substance abuse disorders at the initial interview were poorer than remaining Per–Mag group members on GAS ratings, $t(188) = 3.33$, $p < .01$, and on attained social position, $t(189) = 3.13$, $p < .01$, at the follow-up.

Hierarchical Regression Analyses Examining Predictors of Substance Abuse

Two separate regression analyses were computed for the entire sample using the follow-up ratings of heaviest impairment in functioning caused by alcohol use and the measure of heaviest drug interference as the dependent measures. Ratings from the initial interview of psychoticlike experiences, antisocial behavior, overall social adjustment, and depression were entered sequentially for each analysis. The only significant predictor of alcohol impairment was antisocial behavior (increment in $R^2 = .08$). Significant predictors of heaviest drug interference rating were psychoticlike experiences (increment in $R^2 = .02$), antisocial behavior (increment in $R^2 = .16$), and depression (increment in $R^2 = .02$).

Discussion

Psychosis-prone individuals, identified by the Per–Mag scales, and individuals with antisocial traits, identified by the Noncon scale, exceeded matched control group members on the proportion of participants diagnosed with DSM–III–R (American Psychiatric Association, 1987) substance abuse and dependence, as well as on rates of substance use at the 10-year follow-up evaluation. These findings are parallel with ECA reports (Regier et al., 1990) of increased rates of substance abuse in patients diagnosed with psychosis and antisocial personality disorder. The increased rate of substance use disorders in the Per–Mag group relative to the control group was not simply the result of a heightened rate of psychotic patients in the Per–Mag group, because these differences remained when the psychotic participants were omitted from the analyses. The findings strongly indicate that compensated individuals, identified as at risk for developing psychosis, demonstrate patterns of substance use and abuse parallel with those of psychotic patients. The increase in rates of substance abuse between Per–Mag and Noncon individuals and control group members (77% and 100% increases, respectively) is of clinical importance.

The rate of alcohol use disorders at the follow-up reported in the control group (12%) was consistent with the ECA rate for college educated adults (10%–15%), whereas the rate of drug use disorders in the control group (9%) was slightly above the ECA rates (5%–8%; Robins et al., 1984). As expected, the rate of substance use disorders was higher for men than women. However, the findings of increased rates of substance use disorders for the Per–Mag and Noncon group compared to the control group remained when the groups were compared separately for

gender. The differences between the high-risk groups and the control group are not attributable to gender, because the Per–Mag and Noncon groups, which had higher rates of substance abuse, had larger proportions of women than the control group. Furthermore, the psychosis-prone participants' choice of substances for abuse was consistent with that of schizophrenic patients (Mueser et al., 1990; Schneier & Siris, 1987). The findings of increased alcohol use and abuse in the Per–Mag group are consistent with the ECA findings of increased alcohol use disorders by schizophrenic patients.

Relationship of Psychosis Proneness and Substance Abuse

Psychosis proneness identified in early adulthood by the PerAb and MagicId scales was predictive of subsequent problems with drugs and alcohol. In contrast, substance use disorders at the initial interview were not predictive of clinical psychosis or psychoticlike experiences. These findings are contrary to the hypotheses of McLellan et al. (1979) and Bowers (1987) that the concordance of psychosis and substance abuse indicates that substance use plays an etiological role in psychosis. The results also call into question some explanations of why psychosis-prone and psychotic individuals abuse substances, particularly drugs that tend to produce psychotomimetic symptoms. Schneier and Siris (1987) and Dixon et al. (1990) suggested that schizophrenic individuals use substances in part to counteract the effects of neuroleptic medications. However, only three of the Per–Mag participants reported having used neuroleptic medication.

The finding that a subgroup of Per–Mag individuals abused substances more than a subgroup of Noncon individuals matched on Noncon score indicated that Per–Mag participants' higher rate of substance use is not simply attributable to antisocial traits. The results also indicated that the findings of greater substance abuse by the Per–Mag group was predicted by psychosis proneness and not simply by general psychopathology. One manner of ruling out the role of general psychopathology is that cross-sectional and longitudinal data had demonstrated that Per–Mag individuals are psychosis prone, whereas control group members are not. Second, Per–Mag individuals with other psychopathological symptoms at the initial assessment, namely depression, anxiety, and mania, did not differ from the remaining Per–Mag group members on rates of substance use disorders at the follow up. Furthermore, Per–Mag individuals who were especially psychosis prone but did not have mood disorders at the follow up had higher rates of substance use disorders than the control group members.

Consistent with Chapman, Chapman, Kwapil, Eckblad, and Zinser (1994) , the findings of the present study suggest that psychosis-prone individuals identified by the Per–Mag scales demonstrate behaviors similar to those of psychotic patients. Specifically, the finding that psychosis-prone individuals have heightened rates of substance use and abuse is similar to reports for psychotic patients. This is consistent with the widespread view that there are psychosis-prone individuals who are not psychotic but who demonstrate traits and symptoms similar to those expressed in full-blown psychotic patients. The present study does not purport to

explain why psychosis-prone individuals are at heightened risk for abusing substances (which appears to be part of the larger question of why psychotic patients show a heightened rate of drug abuse).

Subgroups Hypothesized to be at Increased Risk for Substance Abuse

The most deviant subgroup on measures of substance use was participants who qualified for both the Per–Mag and Noncon groups. Nineteen of the 33 antisocial psychosis-prone individuals met criteria for at least one substance use disorder during the 10-year follow-up period. In contrast, the PhyAnh group, as hypothesized, did not differ from the control group on any of the alcohol or drug measures. The findings for the PhyAnh group are consistent with Chapman, Chapman, Kwapil, Eckblad, and Zinser's (1994) conclusion that the PhyAnh individuals are not psychosis prone. It was speculated that participants who scored deviantly low on the PhyAnh scale would be excessively sensation seeking and at an increased risk for developing substance use problems. These “hedonic” individuals did have a significantly higher rate of substance use disorders than the remaining participants in the total sample. However, it was not possible to separate the effects of “hedonia” from psychosis proneness, because more than 75% of the 50 hedonic individuals were also Per–Mag group members, whereas less than 35% of the remaining participants were Per–Mag members. The group composition is consistent with Chapman, Chapman, and Miller's (1982) report that the PhyAnh and PerAb scales were negatively correlated. Furthermore, the hedonic participants did not differ on substance use disorder from the remaining sample when the analysis was limited to the Per–Mag group.

Limitations of the Present Study

The present longitudinal study was originally undertaken as an investigation of putatively psychosis-prone individuals, not as a study of the development of substance abuse. Therefore, participants were selected on the basis of their hypothesized risk for psychosis rather than for risk for drug and alcohol abuse. Furthermore, all of the participants were White and were enrolled in a midwestern university at the onset of the study. Therefore, the findings may not generalize beyond this demographic group.

Conclusions

Psychosis-prone individuals, identified by the Per–Mag scale, exhibited patterns of substance use and abuse like those reported for schizophrenic individuals. Measures of psychosis proneness predicted substance abuse whereas substance abuse did not predict clinical psychosis or other measures of psychosis proneness. In addition the finding that psychosis-prone individuals demonstrated patterns of substance use parallel to those reported in clinically psychotic patients provides further construct validation of the Per–Mag scale as a measure of psychosis proneness.

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