

A Systematic Evaluation of the DSM-III-R Criteria for Alcohol Dependence

Wolfgang Hiller, Werner Mombour, and Josef Mittelhammer

The diagnostic efficiency of the nine DSM-III-R criteria (signs and symptoms) for alcohol dependence was systematically investigated in a sample of 215 psychiatric outpatients. Specificity was generally >0.90 , but two groups of criteria were distinguished according to high v moderate sensitivity rates. The diagnostic relevance of all DSM-III-R criteria was strongly supported by a comparison with additional characteristics of alcoholism. Features referring to impaired control over alcohol use and to physical dependence (tolerance and withdrawal) were found to be most clearly discriminating between subjects with and without alcohol dependence. There is strong evidence that two positive criteria are sufficient to reliably diagnose alcohol dependence. A computer-simulated analysis was performed to demonstrate predictive power of single symptoms under different base rate conditions, and results were promising for the most common settings in clinical research.

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SUBSTANTIAL REFORMULATIONS for the diagnostic concept of alcohol dependence and abuse have been introduced into the revised third edition of the Diagnostic and Statistical Manual, DSM-III-R.¹ In accordance with widely accepted theoretical and empirical advances in the field of alcoholism research,²⁻⁴ the diagnosis of alcohol dependence is no longer restricted to the presence of physical symptoms (i.e., tolerance or withdrawal). It had been argued that these symptoms must not necessarily be found in alcoholics. For example, tolerance could be masked by large individual variations in response to alcohol, there may be reversed tolerance, and withdrawal often is prevented by continuous drinking.⁵

The DSM-III-R definition of alcohol dependence has been broadened to include biological, behavioral, and social components with comparable weight.^{5,6} It contains key elements of a core dependence syndrome formulated by Edwards et. al.^{3,4,7-9} The nine DSM-III-R criteria indicate compulsive forms of drinking as well as negative effects on psychological functioning (e.g., impaired control and alcohol use despite social or occupational disadvantages). None of the criteria is obligatory, and the number of positive symptoms is thought to be related quantitatively to the severity of the disorder. The distinction between a dependence syndrome and alcohol-related disabilities³ has been considered. DSM-III-R has further modified the category of alcohol abuse that now represents a residual diagnosis for mild stages of alcoholism (i.e., continuing involvement with alcohol, but not severe enough to fulfill criteria for dependence).^{1,6}

The revision of the DSM-III alcohol-related categories seems to be accepted as an important improvement,⁶ and the new criteria are thus more likely to be used by researchers and clinicians working in the field of diagnostics and treatment of

*From the Psychiatric Outpatient Department, Max Planck Institute of Psychiatry, Munich.
Supported by Grant No. Mo 439/1-2 of the German Research Foundation (Deutsche Forschungsgemeinschaft).*

Address reprint requests to Wolfgang Hiller, Ph.D., Psychiatric Outpatient Department, Max Planck Institute of Psychiatry, Kraepelinstr 10, D-8000 Munich 40, FRG.

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0010-440X/89/3005-0003\$03.00/0

alcoholism. However, the need remains to evaluate the DSM-III-R criteria (or symptoms) according to their diagnostic efficiency. The DSM-III-R diagnostic method represents much of the current knowledge about the nature and phenomenology of alcoholism, but it is open to further improvements based upon new findings. Field trials must show whether the symptoms used as criteria are indeed good indicators of the disorder. Furthermore, alcohol dependence could probably be diagnosed more efficiently by combining or weighting single criteria, and cut-off values (i.e., the number of symptoms required for a diagnosis) should be optimized empirically.¹⁰

The present report deals with these issues, evaluating the relevance of the DSM-III-R criteria for alcohol dependence in a sample of psychiatric outpatients. We will focus on five questions: (1) How typical are the criteria for subjects with alcohol dependence and to what degree are they unspecific for non-alcoholics? (2) Are the criteria prognostic for the diagnosis of alcohol dependence? (3) How does the diagnostic relevance of the DSM-III-R criteria compare with other characteristics of alcoholism that have not been adopted by DSM-III-R? (4) Can diagnostic accuracy be raised by combining symptoms? (5) Is the current cut-off point for alcohol dependence (a minimum of three criteria is required) adequate?

METHOD

Subjects

Data were collected from 215 adult outpatients (18 years minimum age) with or without patterns of alcohol involvement. They were examined within an 18-month period in the Psychiatric Outpatient Department of the Max-Planck-Institute of Psychiatry in Munich by one of five clinicians (physicians and psychologists), all with experience in psychiatric evaluation and treatment. Of the patients, 65% were referred from a general hospital where they had been treated for physical complaints, including disorders due to inadequate alcohol consumption (e.g., acute intoxication, delirium, alcohol-induced seizures, polyneuropathy, and diseases of the liver or the pancreas). Thirty-five percent of the patients were referred by psychiatrists in private practices and general practitioners for psychiatric diagnostics and treatment proposals. Most patients who were seen because of alcohol-related problems had previously been detoxicated in a hospital, and they had then sought help in order to avoid further abuse of alcohol.

Assessment Methodology

Diagnostic signs, symptoms, and criteria were assessed throughout by use of the Munich Diagnostic Checklist (MDCL), an extensive, structured instrument recently developed by us¹¹ for obtaining data relevant to 33 of the most prevalent and common DSM-III-R disorders (including all categories from the affective, psychotic, organic, and substance-use sections). The MDCL contains several hundred diagnostically relevant criteria, forming the basis for a computer program that generates diagnoses after complete ratings. The instrument was designed mainly for clinical examinations of psychiatric outpatients. The clinician uses the instrument as a semistructured guideline during exploration. Present status as well as longitudinal findings (course) are considered. Thus, lifetime diagnoses are available.

An extensive, face-to-face interview was performed with each patient for approximately 30 to 120 minutes. The interview was usually conducted in one sitting. Use of the MDCL was carefully demonstrated and practiced with each interviewer before the first application. Each rating was followed by direct daily supervision. When questions arose, specific patients were recontacted for further clarification, and additional information was obtained from family members and/or physicians and therapists who previously had seen the patients.

In addition, all patients completed the self-assessment section of the Munich Alcoholism Test (MALT),¹² including 24 statements about drinking behavior, attitude toward drinking, emotional and social impairment due to alcohol, and somatic complaints (all items could be answered on a dichotomous scale by "yes" or "no"). The MALT had been developed in 1977 by Feuerlein et al.^{12,13} to differentiate between alcoholics and nonalcoholics (including healthy individuals as well as individuals suffering from

illnesses other than alcoholism). It was designed according to World Health Organization concepts of alcoholism. Versions in the English and Spanish languages were published in 1980.^{12,13} The 24 self-rating items of the MALT are combined with a seven-item schedule for assessment by the diagnostician based on a physical examination, laboratory findings, the patient's history, and information gained from family and friends. These ratings were made by the same clinician who screened the patient by use of the MDCL according to DSM-III-R diagnoses. The clinician was kept blind to the MALT self-rating scores. The items of the MALT will be described in detail in the section in which results are discussed.

Subject Characteristics

From the total sample of 215, 152 patients (70.7%) received lifetime DSM-III-R diagnoses of alcohol dependence and four (1.9%) received diagnoses of alcohol abuse. Among the remaining 59 patients (27.4%) without any alcohol problems, the following principal DSM-III-R diagnoses were found: 19 (32.2%) mood disorders; nine (15.3%) anxiety disorders; five (8.5%) drug dependence; five (8.5%) personality disorders; four (6.8%) chronic organic mental disorders; three (5.0%) schizophrenia; and 14 (23.8%) other disorders (including eating, somatization, and sexual disorders).

Of the subsample of 152 patients with alcohol dependence, 66 (43.4%) received no other additional diagnoses for mental disorders. Among the remaining patients, 19 (22.1%) presented with a coexisting drug dependence, 29 (33.7%) with a unipolar mood disorder (major depression or dysthymia), six (7.0%) with a bipolar mood disorder (atypical bipolar disorders or cyclothymia), nine (10.5%) with anxiety disorders, eight (9.3%) with chronic organic mental disorders, ten (11.6%) with personality disorders, and five (5.8%) with other disorders.

The sociodemographic characteristics of the total sample at the time of investigation were as follows: aged 39.5 ± 11.1 (mean \pm SD) with a range between 18 and 74 years; 126 men and 89 women; 76 married, 90 single, 41 divorced or separated, and eight widowed; educational level: 75 primary school with or without graduation; two school for retarded children; 73 college; 36 vocational schools; 27 university or comparable institution; two other schools.

Statistical Procedures

Data analysis was performed according to the principles and statistics common within actuarial decision theory.¹⁴⁻¹⁶ These methods have been introduced into the field of psychiatric diagnostics for a detailed analysis of biological tests,¹⁴ and especially for the evaluation of criteria within operationally defined categories.¹⁰ To express the relationship between symptom (or criterion) and diagnosis, we computed the following conditional probabilities: (1) sensitivity (the probability of having the symptom given that the disorder is present); (2) specificity (the probability of not having the symptom given that the disorder is not present); (3) false-positive (FP) rate (symptom being present despite absence of the diagnosis, or 1 minus specificity); (4) false-negative (FN) rate (symptom being absent despite presence of the diagnosis, or 1 minus sensitivity); (5) positive predictive power (PPP) (rate of diagnoses among patients with the symptom); and (6) negative predictive power (NPP) (rate of diagnoses being absent among patients who do not have the symptom).

Values of sensitivity and specificity are additionally summarized by the ϕ coefficient, the product-moment correlation for two binary variables.¹⁶ In our study, ϕ was calculated between criterion and diagnosis for each of the criteria to be

evaluated, with variables containing only presence *v* absence information. ϕ values of 1 indicate perfect agreement between criterion and diagnosis. If both sensitivity and specificity are high for a particular criterion, a ϕ coefficient close to unity results. Lowered ϕ values must be expected as sensitivity, specificity, or both rates decrease. Thus, ϕ represents a rather global measure of diagnostic relevance of criteria.

RESULTS

Basic Evaluation Data

For the evaluation of the nine DSM-III-R diagnostic criteria (symptoms) of alcohol dependence, the sample was subdivided into patients with and without a diagnosis of alcohol dependence (152 and 63, respectively). The complete evaluation data are given in Table 1.

Specificity is perfect or almost perfect for all criteria. All values are >0.90 . Maximum specificity was obtained for four criteria (3,4,5, and 7), indicating that *no* patients without alcohol dependence devoted much time to drinking, experienced interference of alcohol drinking with major role obligations, gave up important activities because of alcohol, or reported a markedly increasing tolerance. Generally, all DSM-III-R criteria were found to be very untypical and uncommon in patients without the disorder of alcohol dependence.

The results are somewhat less unequivocal for the alcohol dependent subsample. Only four criteria (1,2,6, and 8) received satisfactory sensitivity values (range, 0.87 to 0.94), while the figures for the remaining symptoms were found to be <0.70 (range, 0.67 to 0.53). These symptoms were absent in a considerable proportion of the patients with alcohol dependence.

The situation can be analyzed more comprehensively from Fig 1 in which the nine criteria are displayed simultaneously according to their sensitivity and specificity. Two groups of criteria could be separated qualitatively, with only criteria 1,2,6, and 8 showing high values in both rates. These symptoms discriminated between alcohol dependent and nondependent patients, and they include the occurrence of characteristic withdrawal symptoms, specific drinking patterns (drinking excessively despite serious problems), and loss of control over alcohol consumption. Withdrawal was

Table 1. Evaluation of DSM-III-R Criteria of Alcohol Dependence

DSM-III-R Criteria	Sensitivity	Specificity	FP	FN	ϕ	PPP	NPP
(1) Excessive drinking	0.90	0.97	0.03	0.10	0.82	0.99	0.79
(2) Desire or efforts for control	0.87	0.95	0.05	0.13	0.77	0.98	0.75
(3) Much time devoted to alcohol	0.67	1.00	0.00	0.33	0.61	1.00	0.56
(4) Interference with role obligations	0.53	1.00	0.00	0.47	0.50	1.00	0.47
(5) Important activities given up	0.54	1.00	0.00	0.46	0.51	1.00	0.47
(6) Drinking despite major problems	0.90	0.91	0.09	0.10	0.78	0.96	0.79
(7) Tolerance	0.61	1.00	0.00	0.39	0.56	1.00	0.52
(8) Withdrawal symptoms	0.94	0.97	0.03	0.06	0.88	0.99	0.87
(9) Drinking to relieve withdrawal	0.57	0.98	0.02	0.43	0.51	0.99	0.48

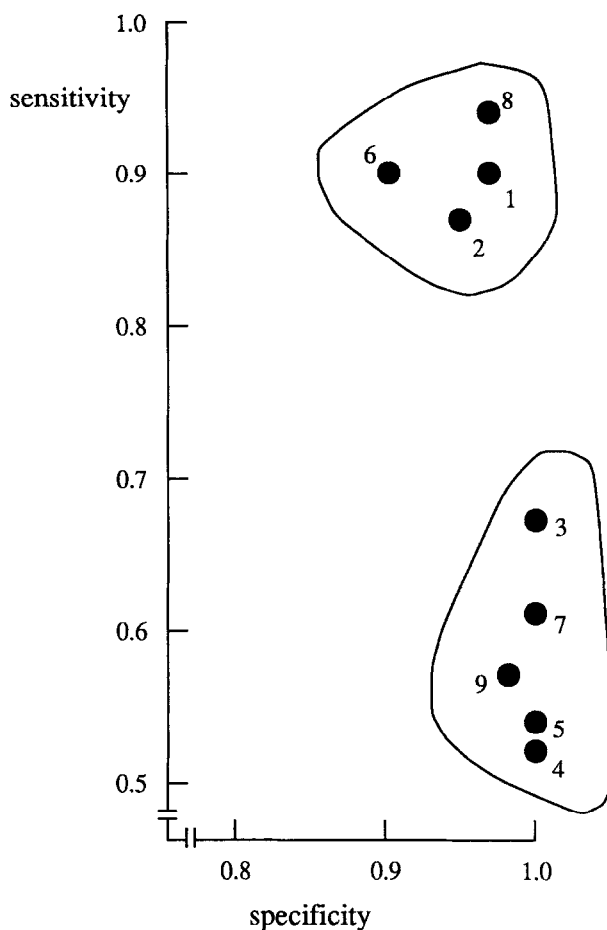


Fig 1. Sensitivity and specificity for the nine diagnostic criteria of DSM-III-R alcohol dependence.

the symptom that was most discriminating, since it was found in 94% of the patients with alcohol dependence (sensitivity), and it was absent in 97% of the nonalcoholic patients (specificity). This subdivision of the nine criteria into two qualitatively distinct groups, as illustrated in Fig 1, is also reflected by an analysis of global ϕ coefficients (Table 1). The four most precisely discriminating criteria of the first group correlate between 0.77 and 0.87 with the diagnosis of alcohol dependence. For the remaining five criteria, values ranging from 0.50 to 0.61 were calculated.

When the criteria are analyzed according to their predictive values under the present sample conditions, all symptoms proved to be highly efficient indicators for the diagnosis in case of their presence (PPP). However, shortcomings in the diagnostic efficiency of the five criteria of the second group (3,4,5,7, and 9) can be seen by simultaneously considering PPP and sensitivity rates (together with the corresponding FN rates, defined as 1 minus sensitivity). Although all symptoms are always or nearly always right in their diagnosis (PPP), these symptoms did not identify between 33% (criterion 3) and 47% (criterion 4) of the patients with the disorder.

NPP rates show that the usefulness of all symptoms as exclusion criteria (i.e., their indicative value for the absence of the diagnosis given that the symptom is absent) is generally lower than their significance as inclusion criteria (see PPP

rates). Except for the withdrawal symptom (criterion 8 with NPP of 0.87), NPP rates are <0.80 (range 0.47 to 0.79). Diagnostic prediction was wrong almost as often as right, if made by interference with role obligations, important activities given up, or drinking to avoid or relieve withdrawal symptoms (criteria 4,5, and 9 with FN rates >0.40).

Predictive Power and Base-Rate Conditions

Unlike sensitivity and specificity, the predictive power of a symptom can be analyzed only in dependence from specific prevalence or base-rate conditions (i.e., the rate of occurrence of the index diagnosis in the population or in a particular sample).^{10,14} It can be shown from Bayesian principles that the PPP of a symptom tends to decrease in studies with a relatively small number of diagnostically positive cases, while NPP increases inversely to base rates.¹⁶ Different prevalence rates of alcohol dependence must be expected under various settings (e.g., high rates in hospitals specialized in treatment of substance dependencies and lower rates in more general psychiatric clinics), and we therefore evaluated in detail the impact of base rates on the predictive power of the DSM-III-R criteria of alcohol dependence.

Figure 2 demonstrates a microcomputer-assisted simulated analysis of PPP and NPP for criteria 9 (drinking in order to relieve or avoid withdrawal) and 8

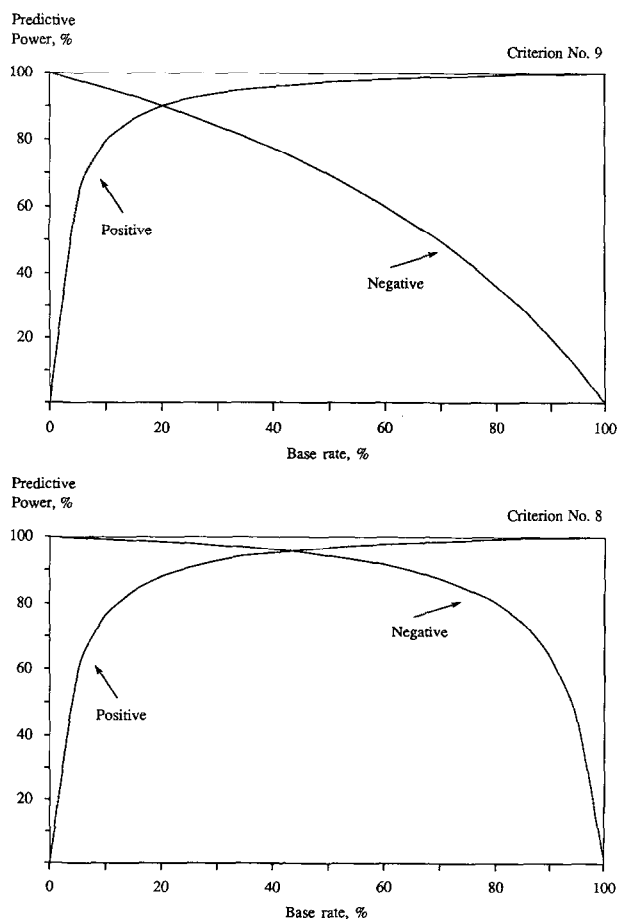


Fig. 2. Effect of base rate on the predictive power of criteria 9 and 8 from the DSM-III-R category of alcohol dependence.

(withdrawal symptoms) across the complete spectrum of possible base rates of the index diagnosis (alcohol dependence), assuming sensitivity and specificity as reported in Table 1. Criterion 8 was chosen as an example from the group of symptoms with highest sensitivity/specificity values, and criterion 9 from the remaining symptoms with lowered sensitivity rates (we deliberately choose symptoms with specificity <1 , since perfect specificity leads to maximum PPP estimates of one over the entire base rate spectrum. However, one would probably never expect an FP rate to be 0 if enough cases were available).

Figures 1 and 2 illustrate the reciprocal relationship between PPP and NPP. The PPP of criterion 9 appears to be satisfactory (>0.80) as soon as base rates are $\geq 10\%$. However, NPP decreases rapidly as base rates increase, and an NPP of <0.80 is already reached at a base rate of $\sim 35\%$. In contrast, the more sensitive criterion 8 shows high rates for both PPP and NPP in the base rate range from $\sim 12\%$ to 80% . This symptom thus appears to be a reliable predictor for presence *and* absence of alcohol dependence in a variety of study settings. Nevertheless, caution in positive prediction is required in broader screenings within a more general population (epidemiological surveys) with typically low prevalence rates. If base rates are expected to be $\geq 80\%$ (e.g., alcohol clinic), the predictive power of the absence of a symptom (NPP) in affirming the absence of alcohol dependence dramatically decreases.

Comparison With Other Characteristics of Alcoholism

In order to arrive at a more general judgement about the diagnostic significance of the DSM-III-R criteria, additional characteristics of alcoholism were analyzed in the same sample. These symptoms are, to some extent, not inherent in DSM-III-R, but they could potentially be included as additional or alternative diagnostically relevant criteria. The symptoms stem from the MALT.¹² Table 2 gives the 24 questions to be answered by the patient (self-assessment section), and the seven items to be reported by the clinician. Since this report focuses on the evaluation of individual symptoms and characteristics, any overall scores (as available in the MALT) will not be further discussed. An analysis equivalent to the preceding evaluation of the DSM-III-R criteria was performed. The complete results are given in Table 3.

The highest ϕ coefficients of DSM-III-R criteria (including criteria 1,2,6, and 8 with ϕ between 0.77 and 0.88) were *not* reached by any of the MALT items. However, there were some qualitatively comparable items to the second group of DSM-III-R criteria (including criteria 3,4,5,7, and 9 with ϕ between 0.50 and 0.61). Sixteen MALT self-rating items had ϕ values >0.50 , but only items 15, 22, 13, and 18 were shown to be somewhat superior to the second group of DSM-III-R criteria. These items focus on self-accusation (items 13 and 18) and the desire or efforts to change drinking habits (items 15 and 22). These features seem to be highly efficient for the distinction between alcoholic and nonalcoholic patients. They are already represented to some degree in the DSM-III-R criteria 1 and 2, and should probably be stressed more in further definitions and refinements of this category.

From the clinician's MALT ratings, only item 4, (daily consumption >150 mL [in women >120 mL] of pure alcohol continued over at least several months), revealed evaluation data comparable with those of DSM-III-R criteria ($\phi = 0.58$). This characteristic could serve as a more precise specification of DSM-III-R criterion 1 (excessive drinking). All other clinician-rated MALT items were highly

Table 2. Items of the MALT

<p>Items to be assessed by the patient as being "true" or "not true"</p> <p>My hands have been trembling a lot recently.</p> <p>In the morning I sometimes have the feeling of nausea.</p> <p>I have sometimes tried to get rid of my trembling and nausea with alcohol.</p> <p>At the moment I feel miserable because of my problems and difficulties.</p> <p>It is not uncommon that I drink alcohol before lunch.</p> <p>After the first glass or two of alcohol I feel a craving for more.</p> <p>I think about alcohol a lot.</p> <p>When I drink a lot of alcohol, I tend to eat little.</p> <p>I have sometimes drunk alcohol even against my doctor's advice.</p> <p>At work I have been criticized because of my drinking.</p> <p>I prefer drinking alone.</p> <p>Since I have started drinking I have been in worse shape.</p> <p>I have often had a guilty conscience about drinking.</p> <p>I have tried to limit my drinking to certain occasions or to certain times of the day.</p> <p>I think I ought to drink less.</p> <p>Without alcohol I would have fewer problems.</p> <p>When I am upset I drink alcohol to calm down.</p> <p>I think alcohol is destroying my life.</p> <p>Sometimes I want to stop drinking, and sometime I don't.</p> <p>Other people can't understand why I drink.</p> <p>I would get along better with my spouse if I didn't drink.</p> <p>I have sometimes tried to get along without any alcohol at all.</p> <p>I'd be content if I didn't drink.</p> <p>People have often told me that they could smell alcohol on my breath.</p>	<p>Items to be assessed by the physician</p> <p>Diseases of the liver (at least one symptom found on physical examination in addition to one positive laboratory test).</p> <p>Polyneuropathy (only if no other cause, e.g., diabetes mellitus, is known).</p> <p>Delirium tremens (on the present examination or previously).</p> <p>Alcohol consumption > 150 mL (women 120 mL) of pure alcohol a day continued over at least several months.</p> <p>Alcohol consumption > 300 mL (women 240 mL) of pure alcohol at least once a month (alcoholic benders).</p> <p>Foetor alcoholicus (at the time of medical examination).</p> <p>Spouse, family members, or good friends have sought help because of alcohol-related problems of the patient (eg., from a physician, social worker, or other appropriate facilities).</p>
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specific (absent in nonalcoholics), but they occurred only in a relatively small proportion of the afflicted patients (e.g., only 39% had diseases of the liver as a consequence of extreme drinking).

In all, the comparison of DSM-III-R with MALT criteria showed that DSM-III-R seems to cover all relevant aspects of alcohol dependence, and the diagnostic relevance of all DSM-III-R criteria was broadly confirmed.

Combinations of Symptoms

The diagnostic efficiency of a single symptom can be improved if it is combined with one or more other symptoms and if the joint symptoms are used for diagnostic prediction (i.e., prediction from the alternative of both symptoms present or not present). Widiger et al.¹⁰ have shown that an analysis of symptom combinations can indicate whether the cutoff points of particular diagnostic categories are optimally-chosen. Therefore, we computed conditional probabilities for the presence and absence of alcohol dependence, given the presence or absence of the combination of two of the symptoms. These data are shown in Table 4. The upper triangle

Table 3. Evaluation of Alcohol Symptomatology as Assessed by the MALT

MALT Symptoms	Sensitivity	Specificity	FP	FN	ϕ	PPP	NPP
Self-Rated							
Hands trembling	0.55	0.76	0.24	0.45	0.28	0.85	0.41
Nausea in the morning	0.45	0.79	0.21	0.55	0.23	0.84	0.37
"Curing" withdrawal with alcohol	0.58	0.97	0.03	0.42	0.50	0.98	0.49
Feeling bad because of problems	0.63	0.44	0.56	0.37	0.07	0.73	0.34
Drinking alcohol in the morning	0.56	1.00	0.00	0.44	0.52	1.00	0.49
Loss of control	0.61	0.97	0.03	0.39	0.53	0.98	0.50
Frequent thoughts about alcohol	0.49	0.97	0.03	0.51	0.44	0.97	0.44
Drinking against doctor's advice	0.64	0.98	0.02	0.36	0.57	0.99	0.53
Loss of appetite when drinking	0.72	0.94	0.06	0.28	0.60	0.97	0.58
Problems at work for drinking	0.39	0.95	0.05	0.61	0.34	0.95	0.39
Prefers drinking alone	0.42	0.97	0.03	0.58	0.38	0.97	0.41
In worse shape because of drinking	0.56	0.98	0.02	0.44	0.50	0.99	0.48
Drinking causes guilty conscience	0.79	0.92	0.08	0.21	0.66	0.96	0.64
Tried out "rules" to limit drinking	0.45	0.95	0.05	0.55	0.39	0.96	0.42
Thinks he should drink less	0.90	0.81	0.19	0.10	0.70	0.92	0.77
Thinks alcohol causes problems	0.69	0.97	0.03	0.31	0.59	0.98	0.56
Drinks to calm down when upset	0.74	0.95	0.05	0.26	0.63	0.97	0.61
Thinks alcohol destroys his life	0.74	0.97	0.03	0.26	0.65	0.98	0.61
Ambivalent feelings about drinking	0.69	0.92	0.08	0.31	0.55	0.95	0.55
Feels others can't understand him	0.66	0.97	0.03	0.34	0.57	0.98	0.54
Alcohol causes problems with partner	0.64	1.00	0.00	0.36	0.58	1.00	0.53
Has tried to live abstinent	0.93	0.75	0.25	0.07	0.69	0.90	0.80
Would be content if abstinent	0.73	0.93	0.07	0.27	0.60	0.97	0.58
Others noticed foetor alcoholicus	0.44	0.97	0.03	0.56	0.40	0.97	0.42
Diagnostician-Rated							
Diseases of the liver	0.39	0.97	0.03	0.61	0.36	0.97	0.40
Polyneuropathy	0.09	1.00	0.00	0.91	0.16	1.00	0.31
Delirium tremens	0.18	1.00	0.00	0.82	0.25	1.00	0.34
150 mL alcohol/day	0.64	1.00	0.00	0.36	0.58	1.00	0.53
300 mL alcohol/day/once a month	0.51	0.97	0.03	0.49	0.45	0.97	0.45
Foetor alcoholicus	0.06	1.00	0.00	0.94	0.13	1.00	0.31
Others sought help for the patient	0.17	1.00	0.00	0.83	0.24	1.00	0.33

Table 4. Evaluation of Pairwise Combined Diagnostic Criteria for Alcohol Dependence (Conditional Probabilities)

Criterion	Sensitivity and Specificity/PPP and NPP								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Excessive drinking		.82/1	.64/1	.46/1	.49/1	.81/.98	.57/1	.84/1	.53/1
(2) Desire or efforts for control	1/.69		.62/1	.46/1	.51/1	.80/.98	.54/1	.82/1	.51/.98
(3) Much time devoted to alcohol	1/.53	1/.52		.41/1	.41/1	.65/1	.43/1	.65/1	.45/1
(4) Interference with role obligations	1/.43	1/.43	1/.41		.34/1	.51/1	.38/1	.51/1	.34/1
(5) Important activities given up	1/.45	1/.46	1/.41	1/.39		.51/1	.40/1	.51/1	.38/1
(6) Drinking despite major problems	.99/.68	.99/.67	1/.54	1/.46	1/.46		.57/1	.86/.98	.55/1
(7) Tolerance	1/.49	1/.47	1/.42	1/.40	1/.41	1/.49		.57/1	.38/1
(8) Withdrawal symptoms	1/.72	1/.70	1/.54	1/.46	1/.46	.99/.75	1/.49		.56/1
(9) Drinking to relieve withdrawal	1/.47	.99/.45	1/.43	1/.38	1/.40	1/.48	1/.40	1/.49	

NOTE. Positive criterion: presence of both symptoms; negative criterion: all other combinations.

(right-hand side) gives sensitivity/specificity values, and PPP/NPP rates are displayed in the lower triangle (left-hand side). With only four exceptions (concerning combinations between criteria 1,2,6,8, and 9), perfect specificity and certainty in the PPP of diagnoses was reached (i.e., values of 1). This means that, in our setting of a general psychiatric outpatient clinic, there was a neglectable proportion of nonalcoholics presenting with a combination of two symptoms, and the coexistence of any two of the nine symptoms was sufficient to assess a certain or highly confident diagnosis of alcohol dependence. Thus, for the prediction of alcohol dependence on the basis of individual symptoms, it was not necessary to consider three of the nine criteria as required by DSM-III-R. As far as a diagnostic decision was concerned, more than two symptoms did not yield additional precision.

However, if symptom combinations as outlined above are used as critical criteria, we have the disadvantage that both sensitivity and NPP rates decrease beneath the level obtained for each criterion alone (Tables 1 and 4). For example, withdrawal symptoms (criterion 8) were found in 94% of the alcoholic subsample (sensitivity), but the combination of withdrawal and the symptom of giving up important activities because of alcohol consumption (criterion 5) was present in only 51%. Analyzing NPP, the absence of withdrawal symptoms could be used to correctly identify 87% of the nonalcoholic patients, but if the absence of the symptom combination (withdrawal *and* giving up important activities) was taken to predict an absence of alcohol dependence, a correct assignment could be made in only 46%.

In other words, since the absence of withdrawal was found in only a few dependent patients (1 minus sensitivity = 6%), this criterion proved to be a good predictor for absence of the disorder. In comparison, the simultaneous presence of withdrawal and the symptom of giving up important activities was present in only 51% of the alcohol-dependent patients, thus absent in 49%. For this reason, the event that both symptoms did not occur concurrently (i.e., lack of simultaneous presence) was in no way typical for the nondependent subsample, and prediction accuracy for nondependence dropped below chance expectation (NPP = 0.46).

In order to raise sensitivity and NPP rates, the simultaneous absence of two symptoms should be regarded as more relevant for diagnosis. Therefore, we repeated the analysis for symptom combinations, this time defining the presence of

the criterion as the occurrence of the first *or* the second symptom (or both) compared with the absence of *both* symptoms (defined as criterion being absent).

The results of this analysis are given in Table 5. By far, most of the symptom combinations reach satisfactory sensitivity and NPP rates (most >0.90 for sensitivity and >0.85 for NPP). For the example given above, either withdrawal or the symptom of giving up important activities was found in 97% of the patients in the dependent group (sensitivity) and both symptoms were absent as well in 97% of the nonalcoholic subsample (specificity). This combined criterion, if absent, could be used to correctly assign 94% of the patients to the nonalcoholic group (NPP). The most impressive values were reached for the combination of tolerance and withdrawal (criteria 7 and 8 with sensitivity of 0.98 and specificity of 0.97). Figure 3 shows that these two symptoms yield excellent PPP and NPP (>0.80) in the base rate range from $\sim 10\%$ to 95%. Values for specificity and PPP were only slightly lower than in the first analysis (Table 4), but satisfactory throughout. Hence, if two symptoms were connected in a manner that the presence of at least one of them is indicative for alcohol dependence—as opposed to the absence of both of them as a sign of absence of alcohol dependence—a surprisingly high overall agreement could be reached in our study between this combined criterion and the diagnosis.

DISCUSSION

Diagnostic categories have been set up and formulated in order to define specific disorders and they typically aim at an inclusion of the most relevant psychopathological signs and symptoms. There are two important reasons for considering a symptom to be of diagnostic significance for a disorder. First, the symptom should be characteristic for the majority of patients included in the category, or second, its presence should have important therapeutic consequences.

For alcohol dependence, the first issue was investigated in the outpatient study reported here, and all nine DSM-III-R symptoms (criteria) proved to be impressively relevant for diagnosis. This result is consistent for both internal and external analysis, i.e., concerning only the specific set of DSM-III-R criteria as well as a

Table 5. Evaluation of Pairwise Combined Diagnostic Criteria for Alcohol Dependence (Conditional Probabilities)

Criterion	Sensitivity and Specificity/PPP and NPP								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Excessive drinking		.95/.92	.93/.97	.96/.97	.94/.97	.99/.89	.93/.97	.99/.94	.93/.95
(2) Desire or efforts for control	.97/.88		.92/.95	.93/.95	.90/.95	.97/.87	.94/.95	.99/.92	.93/.95
(3) Much time devoted to alcohol	.99/.85	.98/.83		.79/.1	.80/.1	.92/.91	.86/.1	.97/.97	.78/.98
(4) Interference with role obligations	.99/.91	.98/.86	1/.66		.72/.1	.92/.91	.76/.1	.96/.97	.76/.98
(5) Important activities given up	.99/.87	.98/.80	1/.67	1/.60		.93/.91	.76/.1	.97/.97	.72/.98
(6) Drinking despite major problems	.96/.97	.95/.92	.96/.83	.96/.83	.96/.84		.94/.91	.98/.89	.92/.89
(7) Tolerance	.99/.86	.98/.87	1/.74	1/.64	1/.63	.96/.86		.98/.97	.80/.98
(8) Withdrawal symptoms	.97/.98	.97/.97	.99/.92	.99/.91	.99/.94	.96/.95	.99/.95		.95/.95
(9) Drinking to relieve withdrawal	.98/.86	.98/.85	.99/.65	.99/.63	.99/.60	.95/.82	.99/.67	.98/.88	

NOTE. Negative criterion: absence of both symptoms; positive criterion: all other combinations.

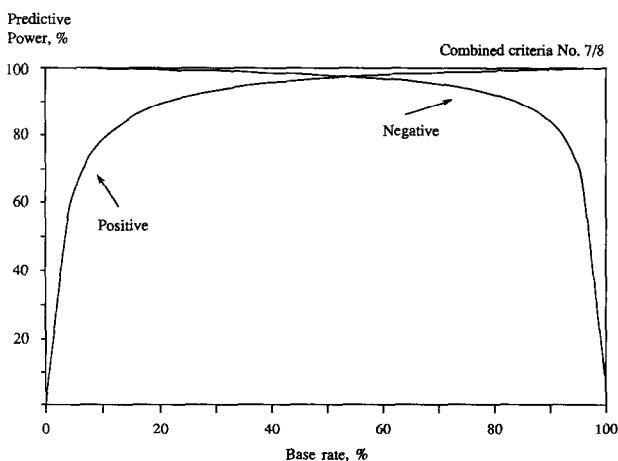


Fig 3. Effect of base rate on the predictive power of a combination of criteria 7 and 8 from the DSM-III-R category of alcohol dependence.

comparison with additional features of alcoholism that are not inherent in the DSM-III-R classification.

Rarely were all DSM-III-R criteria found in patients without alcohol dependence ($\leq 9\%$). However, our results suggested that we subdivide the set of criteria into two groups, with five of the nine criteria being somewhat less sensitive (occurring in only 53% to 67% of the alcoholics). Yet, this finding is not in variance with current concepts of the alcohol dependence syndrome, assuming that no single symptom is absolutely necessary to be present in the disorder of alcohol dependence.^{5,9,17}

Throughout our analyses, criteria and symptoms referring to loss of control over alcohol use showed best discriminative values. In terms of the DSM-III-R concept, drinking against one's own intention (criterion 1), not being able to reduce or stop alcohol consumption (criterion 2), and the failure to change drinking habits even under the pressure from social or somatic problems (criterion 6) were the most valuable characteristics of alcohol dependence. In our sample, they were present in the majority of alcoholics (87% to 90%) and they were absent in nearly all nonafflicted patients (91% to 97%). This finding strongly supports the model of Edwards et al⁴ of a dependence syndrome with focus on impaired control as a cardinal feature.

Tolerance and withdrawal symptoms were removed as obligatory diagnostic criteria, but they nevertheless proved to be highly important features of alcohol dependence. Withdrawal was found more often in alcoholics than tolerance (94% v 61%), but if prediction was based upon the presence of at least one of both symptoms, 99% of our dependent patients were identified. Conversely, 95% of nonalcoholic patients were correctly assigned if both symptoms were absent. This result shows that the two components of physical dependence constitute an important indicator, for inclusion as well as for exclusion, and they certainly represent powerful indicators of alcohol dependence.

With the help of simulated analyses, we demonstrated that most symptoms and symptom combinations can be used as reliable signs of alcohol dependence/nondependence in usual clinical studies. However, attention must be paid if base rates $< 10\%$ to 15% are expected since an increased proportion of patients subjects may be falsely labeled as alcoholic. With base rates $\geq 70\%$ to 80% , a relatively high number of alcoholics would be misclassified as nonalcoholics.

CONCLUSIONS

Good to excellent diagnostic efficiency was found for all symptoms (criteria) of DSM-III-R alcohol dependence. If rated under clinical outpatient conditions, diagnosticians can assume all symptoms to be predictive to a high degree for presence as well as absence of the diagnosis. This represents an important property of items to be employed in screening studies for the detection of serious alcohol problems.¹⁸ There is evidence that two symptoms are sufficient in order to reliably assess the diagnosis of alcohol dependence. However, this finding should not be extended to other than psychiatric outpatient populations, and a reformulation of the DSM-III-R definition of alcohol disorders certainly requires replications of the results presented here. Moreover, additional investigations should be carried out under different clinical settings, since it is well known in diagnostic research^{15,16} that the relevance of individual symptoms is likely to vary in dependence of specific sample or population compositions.

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