37. Cook, P., and Tauchen, G.: The effect of liquor taxes on heavy drinking. Bell J Econ 13: 379-390 (1982).
38. Coate, D., and Grossman, M.: Effects of alcoholic beverage prices and legal drinking ages on youth alcohol use. J Law and Economics 31 April 1988, 145-171. J Law and Economics Res 31: 145-171, April 1988.
39. Hoadley, J., Fuchs, B., and Holder, H.: The effect of alcohol beverage restrictions on consumption: a 25-year longitudinal analysis. Am J Drug Alcohol Abuse 10: 375-401 (1984).
40. DuMouchel, W., Williams, A., and Zador, P.: Raising the alcohol purchase age: its effects on fatal motor vehicle crashes in 26 States. Insurance Institute for Highway Safety, Washington, DC, 1985.
41. Toward the prevention of alcohol problems: Government, business, and community action, edited by D. R. Gerstein. National Academy Press, Washington, DC, 1984, p. 56.

Screening for Alcoholism: Techniques and Issues

JOHN P. ALLEN, PhD, MPA
MICHAEL J. ECKARDT, PhD
JACQUELINE WALLEN, PhD

The authors are staff members of the National Institute on Alcohol Abuse and Alcoholism of the Alcohol, Drug Abuse, and Mental Health Administration, Public Health Service. Dr. Allen and Dr. Wallen are members of the Treatment Research Branch. Dr. Eckardt is with the Laboratory of Clinical Studies, Division of Intramural Clinical and Biological Research.

Tearsheet requests to: Dr. John Allen, NIAAA, Treatment Research Branch, Parklawn 16-C03, Rockville, MD 20857.

Synopsis ....

Alcoholism is an often overlooked health problem because alcoholics usually do not seek treatment for their drinking problems. They do, however, seek general medical care for other health reasons, and a number of screening techniques have proven useful for identifying alcoholics. The advantages and disadvantages of self-report, as well as biochemical techniques that have been found effective in screening for alcoholism, are discussed.

We recommend that future research be aimed at developing quick, accurate, and inexpensive screening devices that also can evaluate the severity of the alcohol problem. Ideally, screening procedures would discourage feigned responses, differentiate between drinking and consequences of drinking, and permit the identification of subtypes of alcoholics. Better understanding of the types of errors made by common screening instruments would enable researchers to construct an optimal sequencing strategy for screening for alcoholism.

ALCOHOLISM is one of our society's most overlooked health problems despite its significant medical, economic, social, and legal consequences. Only about 15 percent of the alcoholics in this county ever enter any type of treatment for alcoholism (1).

Although alcoholics rarely volunteer for treatment for alcoholism, they do seek and receive other kinds of care. For example, a study sponsored by the National Institute of Mental Health has shown that, within a 6-month period, almost 70 percent of individuals with alcohol problems make at least one ambulatory care visit. About 90 percent of these visits are to medical providers rather than to mental health specialists (2). An estimated 15 to 30 percent of medical and surgical patients in general hospitals satisfy clinical criteria for the diagnosis of alcoholism (3). Therefore, general medical care settings appear to be appropriate sites for screening for alcoholism.

Two types of alcoholism screening instruments are currently available to health care practitioners. There are brief interviews, or paper and pencil tests, in which the patient gives a self-report of his or her drinking behavior and its consequences. There are laboratory measures in which enzyme levels and other biochemical test results are analyzed to determine if, individually or in combination, measurements deviate from expected values. Values outside the normal range frequently indicate alcohol-related pathology, especially liver damage, although such a determination may only be possible when other medical conditions and the use of certain medications have been ruled out.

We review examples of both types of screening

procedures, discuss research and clinical practice issues involved in screening for alcoholism, and outline important research needs for alcoholism screening.

Measures of Alcoholism

Self-report measures. Four instruments frequently used to screen for alcoholism are the Michigan Alcoholism Screening Test (MAST), the Addiction Severity Index (ASI), the MacAndrew Scale, and a four-question screening instrument called CAGE. Another instrument, recently developed, is the only one intended for use with adolescents.

MAST is one of the oldest and most commonly used self-report measures of alcoholism (4). MAST consists of 25 items dealing with drinking patterns; social, occupational, and medical aspects of drinking; and previous attempts at treatment. Items are differentially weighted based on their degree of relationship with alcoholism. Hit rates in screening are generally expressed as sensitivity and specificity percentages. Sensitivity refers to the percentage of true positives, and specificity to the percentage of true negatives. Hit rates differ somewhat as a function of the population studied. Hedlund and Viewig, in their review of the literature on MAST, report values in the .80s and .90s (with four studies reaching 1.00) for specificity with a cut score of 5 (5).

Efforts to further improve upon MAST include a version, developed by the Veterans Administration, which also asks about the time at which various symptoms were experienced; several abbreviated forms of the inventory; and the Self-Administered Alcoholism Screening Test (SAAST) (6). SAAST differs from its parent by including an additional nine items on symptoms, internal checks for consistency of responses, and the use of simple unit weights for scoring items. SAAST has been reported to have a sensitivity of 95 percent and a specificity of 96 percent (7). SAAST appears to have excellent validity (7) even when administered to spouses who report on their alcoholic partners.

ASI differs from MAST in two key respects. ASI attempts to determine the severity of alcoholism, based on collateral associated problems. ASI seems to have applicability for matching patients to appropriate levels or intensities of rehabilitation services. ASI was developed by McLellan and coworkers to serve as a quick means of establishing a psychiatric or substance abuse diagnosis and as a research instrument to assess treatment-related changes in seven problem areas (alcohol, drugs, medical, employment and support, legal, family and social, and psychiatric) (8). Ratings are based on objective and subjective information provided by the client and cover two time periods, the past 30 days and the client's entire life.

ASI seems to have both good inter-rater reliability and test-retest reliability. The measure takes about 45 minutes, and can be used both as a screening instrument and as a means for estimating the severity of drug or alcohol abuse. In addition, it has been used to assist clinicians in determining the intensity of treatment needed. McLellan found that ASI differentially predicted success in inpatient or outpatient treatment as a function of the severity of the patient's adjustment difficulties (9).

CAGE is a self-report screening for alcoholism and the briefest validated screening interview available. CAGE consists of four questions: "Have you felt the need to *C*ut down?"; "Do you feel *A*nnoyed by people complaining about your drinking?"; "Do you ever feel *G*uilty about your drinking?"; and "Do you ever drink an *E*ye-opener in the morning to relieve the shakes?"

Despite CAGE's simplicity, its levels of sensitivity and specificity are quite acceptable (that is, at a cut-score of two affirmative responses, 75 percent of alcoholics are correctly identified as alcoholics and 96 percent of non-alcoholics are correctly identified) (7). CAGE appears to be particularly valuable in a busy medical setting where there is little time to interview patients.

The MacAndrew Scale is unique among self-report screening devices in that it does not ask directly about drinking or effects of drinking. This aspect is important because alcoholics may fail to recall amounts consumed or may fail to associate adverse life consequences with drinking. The scale was developed on purely actuarial grounds (10). Those items on the Minnesota Multiphasic Personality Inventory (MMPI) which were answered differently by male outpatient alcoholics than by male outpatient psychiatric patients were selected for inclusion in the scale. MacAndrew found that the two groups differed in their responses to 49 non-alcohol-related items. Using cut scores from 24 to 28, the MacAndrew Scale has yielded good discrimination between alcoholics and nonalcoholics in a wide range of subsequent studies. The scientific literature on the measure has been critically reviewed by Preng and Clopton (11). While the MacAndrew Scale is in general much less valid than the other pencil-and-paper measures, it appears to have some advantages in that it does not seem readily "fake-able" and may identify specific types

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of alcoholics such as the hedonistic, extraverted, and nonconforming. Additionally, it can be derived as a by-product of a common psychological test without requiring additional testing effort.

"Drinking and You" is a new self-report instrument that was developed for use specifically with adolescents (12). It is mentioned here because most screening instruments for adolescents are simply modifications of instruments used for adults. Normative work on the measure is nearing completion. The test has already been validated against blind clinical judgments, and test-retest reliabilities have also been derived. Convincing convergent and discriminant validity indices have been obtained. "Drinking and You" is a 24-item instrument, appropriate for adolescents aged 12 to 17 years, and requires about 10 minutes to complete. The items tap four conceptual dimensions: loss of control of drinking, social symptoms, psychological symptoms, and physical symptoms.

Additional keys are available to distinguish self-medicating drinking and "aggressive-rebellious" drinking. Overall scores on the test allow adolescents to be classified at three levels of alcohol abuse severity from "minor or no problem" through "moderate problem" to "severe problem." In a recent study this instrument correctly identified 88 percent of adolescents with alcohol problems and 82 percent of those without problems when a dichotomous category distinction was used.

Biochemical measures. There are two basic approaches to identifying biochemical markers of alcoholism. The first relies on routinely requested clinical laboratory tests and the other on specialized laboratory tests.

Statistically significant relationships have been observed between reported alcohol consumption and routinely requested clinical laboratory tests (13–16). Several clinical tests have been described as useful in identifying alcoholics. These are mean corpuscular volume, or MCV (17, 18), and gamma-glutamyl transpeptidase, or GGT (19, 20). Such measures alone, however, have been shown to lack diagnostic specificity (21). This is not surprising in that it is rare that a medical condition can be defined by a single pathognomonic sign or symptom.

The use of multiple-test approaches has been demonstrated to have potential utility (22–24). Combinations of commonly requested clinical laboratory tests have been used to identify persons who have consumed alcoholic beverages in amounts that alter physiological processes (25), or that result in organ dysfunction (26), such as biopsy-verified liver disease (22). Correct classification ranges from 80 to 100 percent accuracy, depending on the population studied and the technique employed.

Some clinical investigators have advocated the use of specialized laboratory tests to diagnose alcoholism, such as 2,3-butanediol (27) and alpha amino-n-butyric acid (28), and several new ones have been proposed.

Two enzymes in blood platelet membranes, monoamine oxidase and adenylate cyclase, have been found to be altered in alcoholics, compared with controls matched for sex and age (29). *In vitro* inhibition of activity of platelet monoamine oxidase by 400 mM ethanol was more pronounced in alcoholics than in controls. It was also reported that *in vitro* stimulation of platelet adenylate cyclase by various agents was less in alcoholics. Analyses of these two enzymes resulted in correct classification of 75 percent of alcoholics and 73 percent of nonalcoholics.

Transferrin is a glycoprotein involved in iron transport. Excessive alcohol consumption has been associated with increasing levels of carbohydrate-deficient form of transferrin, or CDT (30). In several large clinical trials, evaluation of CDT has identified excessive alcohol consumption with 95 percent accuracy, suggesting that it may prove useful as a marker for alcohol abuse (30, 31). CDT has been demonstrated to be useful in identifying black and Puerto Rican alcoholics (81 percent sensitivity and 91 percent specificity). Unfortunately, this study also shows that CDT is often elevated in some nonalcoholic patients with primary biliary cirrhoses (32).

Acetaldehyde is the major metabolite of ethanol and has been shown to bind covalently to certain

proteins forming immunogenic condensation products. Levels of some forms of these acetaldehyde adducts (AA) have been reported to be higher in sera of alcoholic patients (33). For example, hemoglobin has been shown to form a stable adduct with acetaldehyde *in vitro* (34) and has been used successfully to identify alcoholics (35). Moreover, recent data have demonstrated that a specific hepatic protein-AA is present in the liver during periods of ethanol consumption (36).

Issues

Although at least 400 studies have reported on screening for alcoholism, there still are important issues to be addressed.

Purpose of screening. One area of inconsistency in the screening literature relates to the nature and extent of screening as a construct. Some instruments are seen as screening instruments when their purpose goes beyond simple recognition of alcoholism to the assessment of its type and severity. Examples include the Alcohol Use Inventory, the Alcohol Dependence Scale, and the Severity of Alcohol Dependence Questionnaire (37). A distinction can be made between screening (identification of a possible problem in a large unselected group of persons), case-finding (more precise specification of a problem among persons who are known to suffer from some kind of difficulty), and diagnosis (determination of the nature and severity of a problem with recommendations for treatment). The practitioner concerned with alcoholism in patients must decide the particular goal of screening. This decision is related mainly to whether or not the patient will be referred to a specialized agency (and the capabilities of the agency) or treated in-house.

Value of screening. Screening can identify persons who suffer from alcoholism, increasing the likelihood that they will receive effective treatment. While this goal may appear to be ambitious, screening can be part of minimal intervention treatment, which may in fact be quite effective, particularly with those who are in the early stages of alcohol abuse, as demonstrated by the well known Malmo project (38). In this study, 585 men in their mid to late 40s were identified as "heavy drinkers" based on their levels of GGT. At 2- and 4-year followup intervals, GGT levels declined significantly, even for those patients who received only a letter informing them that their liver test showed impairment and advising them to decrease their alcohol

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consumption. Babor and colleagues summarized the importance of this study by noting that it "showed that simple intervention based on regular feedback about a biochemical marker can have significant effects on the drinking habits and physical health of a population" (39).

Practicality of screening. From a clinical standpoint, several characteristics are desirable in a screening instrument or series of screening instruments. Instruments should achieve high levels of validity. Careful consideration must be given to establishing an appropriate cut score, given the base rate of alcoholism in that particular setting and the nature of that setting. A well thought-out compromise must be made between sensitivity and specificity. For example, when a physician in a general medical setting can make referrals to a more specialized diagnostic unit, the major concern must be the sensitivity of the instrument, since false positives can be quickly identified at the next stage of the screening process. However, for certain research purposes, and in any legal proceeding where alcoholism is an issue, specificity may be an equal or more important concern.

Other important practical considerations in the selection of screening techniques deal with such matters as cost, the practitioner's need for immediate results, and the kind of decision that needs to be made about referral.

"Covert" measures. The MacAndrew Scale is less effective than other self-report measures. While it has been criticized, we believe that it is an intriguing instrument because it has some validity, although its item content is restricted to pre-existing MMPI questions. Perhaps a new MacAndrew-like scale with acceptable levels of validity could be created using covert question content, but not limited to the pre-existing questions from the MMPI. For example, items dealing with characteristics that may precede alcoholism (40, 41), such as attention

deficit disorder, sensation seeking, or impulsivity, might be included. Were this instrument to have acceptable levels of validity, it would be an improvement over other self-report measures. Dissimulation would be more difficult. It might identify the problem earlier, and it might be cheaper and less invasive than biochemical measures.

Choosing between biological and self-report measures. The sensitivity and specificity of self-report measures of alcoholism generally exceed those of biochemical measures, a situation which is not likely to change in the near future. Even if innovative specialized laboratory techniques are refined to the point that they obtain levels of validity comparable to self-report measures, the technology required for quantitative assessments and laboratory procedures probably will require greater sophistication than will be available to most primary health care providers.

However, biochemical measures can provide important new information on alcoholism, including more accurate determinations of severity. Biochemical measures may be useful in identifying those who deny being alcoholic, based on their self-report information. Many clinicians in the field of alcoholism believe that primary health care providers will respond more vigorously to patients with alcoholism if the provider has the results of laboratory tests, rather than a score on a self-report measure. Additionally, biochemical measures are essential to diagnosing alcohol-related pathophysiology.

Among their shortcomings, biochemical markers are less revealing when profound physiological changes have not resulted from alcohol consumption, as is the case with adolescents who have not been drinking long enough to produce such organic change, or with some episodic, or binge, drinkers.

An important research question deals with how self-report and physiological measures might be optimally combined. Some initial work in this area has been reported by Skinner and coworkers (42) and by Babor (7). Various measures might be combined or instruments could be administered sequentially. Sequencing might take the form of a decision tree or a regression analysis approach.

Research Directions

Important research directions for studies of alcoholism screening are suggested by the preceding discussion. Work on biochemical measures needs to include developing an inexpensive, accurate measure that provides results quickly for the practitioner and the patient. Ideally this measure would indicate not only the presence of alcoholism but also its severity. While measures of alcohol consumption are needed, they need to be correlated with current psychiatric nomenclature diagnoses rather than excessive consumption itself. Efforts are needed to develop a biochemical measure to screen patients early and identify those whose episodic, heavy drinking pattern is associated with risk.

Future efforts on self-report screening instruments might include deriving covert content items so that new instruments are less subject to feigning. Another research goal is to develop self-report measures for use by adolescents. An additional issue which should be investigated is the conceptual meaning of the self-report screening instruments, asking "What are the instruments actually measuring?" Most instruments yield a single score that allows the clinician to make a dichotomous decision of alcoholic *vs.* nonalcoholic. This single domain view of alcoholism differs sharply from most modern conceptualizations of alcoholism, which posit different types of alcoholism. Current self-report measures, however, do not attempt to identify types of alcoholism.

Finally, future research on self-report measure needs to distinguish dependence from severity of the consequences of drinking. Current psychiatric diagnostic systems place major emphases on dependency, yet many self-report screening items deal with harmful consequences. The consequences of drinking are likely to be less valid correlates of alcoholism, since they are "conditioned" by life style and socio-economic variables. For example, if the alcoholic is a self-employed businessman, there will not be criticism from co-workers or a supervisor, and he will not experience such effects of drinking as arriving at work late owing to drinking, which are common items on self-report screening instruments.

Despite the extensive literature contrasting self-report and biochemical measures, we found no studies analyzing the types of errors each measure makes, although several projects contrasted overall accuracy rates. An analysis of errors might help in developing optimal measure-sequencing strategies.

Research on screening is important because it should yield additional means to identify and appropriately refer alcoholics. As more is learned about the nature of alcoholism, more effective

means will be developed to identify problems quickly, so that early treatment may be initiated, helping to reduce the financial and emotional cost of this disease.

References . . . .

1. National Institute on Alcohol Abuse and Alcoholism: Fourth special report to the U.S. Congress on alcohol and health, Rockville, MD, 1981.
2. Shapiro, S., Skinner, E. A., and Kessler, L. G.: Utilization of health and mental health services: three epidemiologic catchment area sites. Arch Gen Psych 41: 971–978 (1984).
3. Institute of Medicine: Alcoholism, alcohol abuse and related problems, National Academy Press, Washington, DC, 1980.
4. Selzer, M. L.: The Michigan Alcoholism Screening test: the quest for a new diagnostic instrument. Am J. Psych 127: 1653–1659 (1971).
5. Hedlund, J. L., and Viewig, B. W.: The Michigan Alcoholism Screening Tests: a comprehensive review. J Operational Psych 15: 55–65 (1984).
6. Swenson, W. M. and Morse, R. M.: The use of self-administered screening test (SAAST) in a medical center. Mayo Clin Proc 50: 204–208 (1975).
7. National Institute on Alcohol Abuse and Alcoholism: Screening for alcoholism in primary care settings, Rockville, MD, 1987.
8. McLellan, A. T., et al.: Guide to the Addiction Severity Index: background administration and field testing results, DHHS Publication (ADM) 86–1419, Rockville, MD, 1985.
9. McLellan, A. T., Luborsky, L, Woody, G. E., and O' Brien, C. P.: Predicting response for alcohol and drug abuse treatment: role of psychiatric severity. Arch Gen Psychiatry 40: 620–625 (1983).
10. MacAndrew, C.: The differentiation of male alcoholic outpatients from non-alcoholic psychiatric outpatients by means of the MMPI. Q J Stud Alcohol 26: 238–246 (1965).
11. Preng, K. W., and Clopton, J. R.: The MacAndrew Scale: clinical application and theoretical issues. Q J Stud Alcohol 47: 228–236 (1986).
12. Harrell, A. V., and Wirtz, P. W.: Screening adolescents for drinking problems. Paper presented at 1988 National Alcoholism Forum, Arlington, VA, Apr. 23, 1988.
13. Bagrel, A., et al.: Relations between reported alcohol consumption and certain biological variables in an 'unselected' population. Clin Chem 25: 1242–1246 (1979).
14. Papoz, L., et al.: Alcohol consumption in a healthy population: Relationship to y-glutamyl transferase activity and mean corpuscular volume. JAMA 245: 1748–1751, May 1, 1981.
15. Whitehead, T. P., Clarke, C. A., and Whitfield, A. G. W.: Biochemical and hematological markers of alcohol intake. Lancet 1: 978–981, May 6, 1978.
16. Whitfield, J. B., et al.: Some laboratory correlates of drinking habits. Ann Clin Biochem 15:297–303 (1978).
17. Wu, A., Chanarin, I., and Levi, A. J.: Macrocytosis of chronic alcoholism. Lancet 1: 829–831, May 4, 1974.
18. Unger, K. W., and Johnson, D., Jr.: Red blood cell mean corpuscular volume: A potential indicator of alcohol usage in a working population. Am J Med Sci 267: 281–289 (1974).
19. Rosalki, S. B., and Rau, D.: Serum gamma-glutamyl-transpeptidase activity in alcoholism. Clin Chim Acta 39: 41–47 (1972).
20. Wu, A., Slavin G., and Levi, A. J.: Elevated serum gamma-glutamyl-transferase (transpeptidase) and histological liver damage in alcoholism. Am J Gastroenterol 65: 318–323 (1976).
21. Eckardt, M. J., Ryback, R. S., Rawlings, R. R., and Graubard, B. I.: Biochemical diagnosis of alcoholism: a test of the discriminating capabilities of gamma-glutamyl transpeptidase and mean corpuscular volume. JAMA 246: 2707–2710, Dec. 11, 1981.
22. Ryback, R. S., et al.: Biochemical and hematological correlates of alcoholism and liver disease. JAMA 248: 2261–2265, Nov. 12, 1982.
23. Stamm, D., Hansert, E., and Feuerlein, W.: Detection and exclusion of alcoholism in men on the basis of clinical laboratory findings. J Clin Chem Clin Biochem 22: 79–96 (1984).
24. Ryback, R. S., Eckardt, M. J., Rawlings, R. R., and Rosenthal, L. S.: Quadratic discriminant analysis as an aid to interpretive reporting of clinical laboratory tests. JAMA 248: 2342–2345, Nov. 12, 1982.
25. Rawlings, R. R., et al.: A methodology for construction of a multivariate diagnostic instrument: An application to alcohol abuse screening. Comput Biomed Res 15: 228–239 (1982).
26. Ryback, R. S., Eckardt, M. J., and Pautler, C. P.: Biochemical and hematological correlates of alcoholism. Res Commun Chem Pathol Pharmacol 27: 533–550 (1980).
27. Rutstein, D. D., et al.: 2,3-Butanediol: an unusual metabolite in the serum of severely alcoholic men during acute intoxication. Lancet 2: 534–537, Sept. 3, 1983.
28. Shaw, S., Stimmel, B., and Lieber, C. S.: Plasma alpha amino-n-butyric acid to leucine ration: an empirical biochemical marker of alcoholism. Science 194: 1057–1058 (1976).
29. Tabakoff, B., et al.: Differences in platelet enzyme activity between alcoholics and non-alcoholics. N Engl J Med 318: 134–139 (1988).
30. Stibler, H., Borg, S., and Joustra, M.: Micro anion exchange chromatography of carbonhydrate-deficient transferring in serum in relation to alcohol consumption. Alcohol Clin Exp Res 10: 535–544 (1986).
31. Stibler, H., and Hultcrantz, R.: Carbohydrate-deficient transferrin (CDT) in serum in patients with liver diseases. Alcohol Clin Exp Res 11: 468–473 (1987).
32. Behrens, U., et al.: Carbo-hydrate-deficient transferrin, a marker for chronic alcohol consumption in different ethnic populations. Alcohol Clin Exp Res 12: 427–432 (1988).
33. Hoerner, M., Behrens, U. J., Worner, T., and Lieber, C. S.: Humoral immune response to acetaldehyde adducts in alcohol patients. Res Commun Chem Pathol Pharmacol 54: 3–12 (1986).
34. San George, R. C., and Hoberman, H. D.: Reaction of acetaldehyde with hemoglobin. J Biol Chem 261: 6811–6821 (1986).
35. Niemela, O., et al.: Antibodies against acetaldehyde-modified protein epitopes in human alcoholics. Hepatology 7: 1210–1214 (1987).
36. Lin, R. C., Smith, R. S., and Lumeng, L.: Detection of a protein-acetal-dehyde adduct in the liver of rats fed alcohol chronically. Clin Invest 81: 615–619 (1988).
37. Lettieri, D. J., Nelson, J. E., and Sayers, M.: Alcoholism treatment assessment research instruments, Treatment

Handbook Series, DHHS Publication (ADM) 85-1380, Rockville, MD, 1985.

38. Kristenson, H., Trell, E., and Hood, B.: Serum of glutamyl-transferase in screening and continuous control of heavy drinking in middle-aged men. Am J Epidemiol 114: 862-872 (1982).

39. Babor, T. F., Ritson, B. E., and Hodgsdon, R. J.: Br J Add 81: 23-46 (1986).

40. Vaillant, G. E.: The natural history of alcoholism. Harv-
ard University Press, Cambridge, MA (1983).

41. Cox, W. M.: Personality correlates of substance abuse. In Determinants of substance abuse: biological psychological, and environmental factors, edited by M. Galizio and S. A. Maisto. Plenum Press, New York, NY, 1985, pp. 209-246.

42. Skinner, H. A., Holt, S., Shew, W. J., and Israel, Y.: Clinical versus laboratory detection of alcohol abuse: The Alcohol Clinical Index, Br Med J 292: 1703-1708, June 28, 1986.

Trends in Alcohol-Related Morbidity and Mortality

GERALD D. WILLIAMS, DEd
BRIDGET F. GRANT, PhD
FREDERICK S. STINSON, PhD
TERRY S. ZOBECK, PhD
SHERRIE S. AITKEN, DPA
JOHN NOBLE, BA

Dr. Williams is a Senior Associate at CSR, Incorporated, the firm that operates the Alcohol Epidemiologic Data System for the National Institute on Alcohol Abuse and Alcoholism (NIAAA), Alcohol, Drug Abuse, and Mental Health Administration, Public Health Service. Dr. Stinson, Dr. Zobeck, and Dr. Aitken are also with NIAAA's Alcohol Epidemiologic Data System. Mr. Noble is Deputy Director of the Division of Biometry and Epidemiology (DBE), and Dr. Grant is Acting Chief of the Biometry Branch, DBE, NIAAA.

Tearsheet requests to Dr. Gerald D. Williams, Alcohol Epidemiologic Data System, CSR, Incorporated, Suite 600, 1400 Eye St., NW, Washington, DC 20005.

Synopsis ....

Two major trends regarding alcohol use and consequences of alcohol abuse in the United States are showing significant improvement. Continued declines are evident in age-adjusted rates of liver cirrhosis mortality, and per capita alcohol consumption is at its lowest level in 15 years. Two other trends, however, are less clear. After declining in 1982 and continuing through 1984, alcohol-related morbidity—as measured by principal diagnoses listed on short-stay, community hospital discharges—showed a slight increase in 1985. Similarly, after declining every year but one since 1981, alcohol-related motor vehicle fatalities showed a significant increase in 1986.

The downward trends suggest that progress is being made in efforts to reduce alcohol-related deaths and morbidity, but there are no easy explanations for any of the trends. Reductions in liver cirrhosis death rates may reflect coding changes in liver disease categories, less chronic heavy drinking, or better medical care. Lower per capita alcohol consumption may indicate the public's increased awareness of drinking risks or the aging of the U.S. population. Ironically, the recent increase in alcohol-related motor vehicle fatalities may reflect stronger enforcement of drunk driving laws and increased BAC (blood alcohol content) testing.

THE NATIONAL INSTITUTE on Alcohol Abuse and Alcoholism (NIAAA) regularly examines trends in mortality related to liver cirrhosis, alcohol-related fatal traffic accidents, apparent per capita alcohol consumption, and alcohol-related diagnoses in discharges from non-Federal, short-stay community hospitals. These surveillance activities allow the Institute to monitor and analyze both alcohol consumption and key mortality and morbidity indicators that are related to the use and abuse of alcohol.

This paper reports on trends in apparent alcohol consumption and three alcohol problem indicators. The report updates several sections of the epidemiology chapter in the Secretary's "Sixth Special Report to the U.S. Congress on Alcohol and Health" (1). However, the information presented is necessarily brief. More detailed information can be