
Measuring Use of Alcohol and Other Drugs Among Adolescents

ANN J. BLANKEN

Ms. Blanken is a Youth Risk Behavior Surveillance System Chairperson and Deputy Director of the Division of Epidemiology and Prevention Research, National Institute on Drug Abuse, National Institutes of Health.

DESPITE REDUCTIONS in recent years, drug use is widely believed to be greater among youth in America than among youth in any other industrialized nation. An estimated 9.3 million American youth, 46 percent of those ages 12 to 17 living in the general population, have used alcohol; and 4.0 million, 20 percent of those in the same age group, have used an illegal drug other than alcohol (1).

The use of alcohol and other drugs has an enormous impact on the nation's physical, social, and economic health. Much of the economic cost can be attributed to lost productivity (2). Drug-related crimes contribute significantly to our overloaded legal and criminal justice systems. People who misuse alcohol and use other drugs require a disproportionate share of health care services. Families and schools struggle with the adverse impact of the use of alcohol and other drugs among adolescents. Further, the use of these substances may be both a cause and an effect of homelessness (3).

Alcohol and other drug use are preventable behaviors that usually are established during youth and that may extend into adulthood. The use of these substances jeopardizes physical, mental, and social development during a person's formative years, thereby endangering successful transitions from adolescent to adult roles (4). Public and private agencies, including schools, community and business organizations, and State and local departments of education and health, can help children and adolescents avoid, or reduce risks associated with, the use of alcohol and other drugs. The development and nature of programs that effectively accomplish these aims depend in part on information about specific behaviors associated with the use of these substances.

This paper describes the development of questions related to the use of alcohol and other drugs for the Youth Risk Behavior Surveillance System (YRBSS) questionnaire. The YRBSS Panel Participants (see Appendix I, page 56) first identified major short- and long-term health outcomes associated with using these substances.

Guided by national health objectives for the year 2000 (3), we developed questions that would elicit information on priority behavioral dimensions of alcohol and other drug use.

Short-Term Health Outcomes

Even infrequent use of alcohol or other drugs may result in intoxication and acute consequences, especially among youth, who may have low tolerance due to their smaller body size and may lack experience with the effects of alcohol and other drugs. The short-term effects associated with these substances are numerous and complex, and they contribute to some of the leading causes of mortality among youth (3).

Seventy-five percent of all deaths among persons ages 15 to 24 are attributed to four causes: motor vehicle crashes, 35 percent; other unintentional injuries, 10 percent; homicides, 17 percent; and suicides, 13 percent (5). Alcohol use is a factor in approximately half of all deaths from motor vehicle crashes and from intentional injuries (homicides and suicides) (6). Among 15- to 17-year-olds involved in fatal motor vehicle crashes in 1989, 19 percent had been using alcohol at the time of, or shortly before, the crash (7). Alcohol use also has been linked to physical fights, destroyed property, academic and occupational problems, and trouble with law enforcement officials (3).

Drug use contributes directly and indirectly to the epidemic of human immunodeficiency virus (HIV) infection. Persons who inject drugs can become infected through sharing drug injection equipment with infected persons. Injected drug use, the second most common means of HIV transmission in the United States, accounts for 22 percent of cases of acquired immunodeficiency syndrome (AIDS) among persons 13 years old and older and 17 percent of cases among persons 13 to 24 years old. Males who report both (a) homosexual or bisexual contact and (b) injected drug use represent an

additional 4 percent of cases among persons 13 years old and older and an additional 9 percent of cases among persons 13 to 24 years old (8).

Transmission of HIV and sexually transmitted diseases (STD) also can occur indirectly as a consequence of using alcohol and other drugs that can impair judgment and reduce inhibitions about engaging in sexual intercourse (9). Early initiation of sexual intercourse and unintended pregnancy in adolescence also are related to early use of alcohol and other drugs. Some adolescents trade sexual activities for illicit drugs, or for money to buy these substances, and thus place themselves at risk for HIV infection, other STD, and unintended pregnancy (10).

Cocaine-related visits to hospital emergency rooms and cocaine-related deaths reported by medical examiners increased sharply during the 1980s (“Overview of Selected Drug Trends” by E. H. Adams, A. J. Blanken, L. Q. Ferguson, and A. Kopstein, unpublished paper). Cocaine can cause disability or death from myocardial infarctions, cardiac arrhythmias, and strokes (11). Eating disorders, such as anorexia nervosa and bulimia, have been associated with cocaine abuse (12).

Crack cocaine, whose use became widespread in some urban centers during the 1980s, appears to be even more addictive than the powdered form of cocaine (13). Crack use has been associated with increases in STD among adolescents (10).

Other abused stimulants, including amphetamines and methamphetamines such as “speed” and “ice,” have been found to affect brain chemistry. Hallucinogens, such as lysergic acid diethylamide (LSD), phencyclidine (PCP), and mescaline, also produce psychotic-like symptoms, which can lead to unintentional or intentional injuries. Animal studies suggest that PCP can interfere with the acquisition and retention of learned information (14).

Anabolic steroids, often abused for body building and strengthening, have been associated with severe mood swings, aggression, temporary sterility, high blood pressure, and insomnia (15,16). Persons who inject steroids also may place themselves at risk for HIV infection if they share contaminated injection equipment (16).

Alcohol and drug use contribute markedly to infant morbidity and mortality. Alcohol use during pregnancy is the leading preventable cause of birth defects and one of the leading causes of mental retardation (17). Heavy alcohol consumption during pregnancy causes alcohol-related defects and fetal alcohol syndrome (FAS). FAS is characterized by growth retardation, facial malformations, central nervous system disorders including mental retardation, and major organ system malformations (18,19).

In general, illegal drug use during pregnancy is

associated with fetal distress, impaired fetal growth, and developmental problems during infancy, though some studies may not have considered other factors such as mother’s health and nutritional status or the environment (20-22). Exact causality is hard to determine because women who use illegal drugs often smoke cigarettes and use alcohol. Intensive research is being carried out in this area.

Long-Term Health Outcomes

For some people, use of alcohol and other drugs leads to dependence and other adverse health outcomes associated with long-term, compulsive use. Long-term alcohol misuse is associated with liver disease, cancer, cardiovascular disease, and neurological damage. Alcohol-induced liver diseases include fatty liver, alcoholic hepatitis, and cirrhosis (23). In 1987, chronic liver disease was the ninth leading cause of death in the United States (5). From 16 percent to 50 percent of the difference in death rates between the general population and heavy drinkers may be attributed to cardiovascular disease — a reflection of the effects of alcohol abuse on the cardiovascular system (24). According to various estimates, 5 percent to 24 percent of hypertension is associated with alcohol use (25). Alcohol abusers are at increased risk for liver, esophagus, nasopharynx, and larynx cancers (26). Neurological complications of heavy alcohol consumption include dementia, blackouts, seizures, hallucinations, and peripheral neuropathy (27). Alcohol also may affect the immune, endocrine, and reproductive functions (28-31), may cause inflammation of the esophagus, exacerbate existing peptic ulcers, and may cause chronic pancreatitis (27,32,33). Malnutrition resulting from poor eating habits may be a complication of alcohol dependence (34).

Marijuana, the most widely abused illegal drug (1), may cause long-term health problems. Marijuana smoke contains many of the same toxic elements found in tobacco smoke. Since marijuana smoke typically is retained in the lungs longer than tobacco, concerns have been raised about its effects on the respiratory system. Research underscores the potential damage to pulmonary function that can result from chronic marijuana use (35,36).

Inhalants include solvents (for example, gasoline, glues, and paint thinner), aerosols (such as spray paints and lubricants), anesthetic agents (such as nitrous oxide), and volatile nitrites (such as amyl nitrite and butyl nitrite). Chronic use of some inhalants is associated with neurological damage and injury to the liver and kidneys (37). It is unclear whether brain damage related to solvent abuse is permanent or may be reversed after long-term cessation (38).

Controlled substance analogues, popularly referred to as “designer drugs,” can cause serious long-term health problems. Neurotoxic effects of one amphetamine analogue, MDMA (called “Ecstasy” or “XTC”), have been demonstrated through animal studies (39).

Long-term anabolic steroid use may be associated with severe acne, stunted growth, kidney stones, cardiovascular disease, and liver disease (15).

Dependence on alcohol and other drugs often is associated with psychiatric problems, such as depression, anxiety, or antisocial personality disorder. However, the extent and direction of causation, if any, is unclear. Studies of persons seeking drug abuse treatment have found substantial numbers with a diagnosable psychiatric disorder, and studies of psychiatrists’ patients have found that drug abuse often precipitated the patient’s psychiatric problem (40,41). Nearly half (47 percent) of those diagnosed as alcohol abusers or alcohol dependent in the Epidemiologic Catchment Area Survey also met criteria for at least one other psychiatric disorder (42).

National Health Objectives

The national health objectives measured by the YRBSS are given in Appendix III, page 67. Thirteen of the national health objectives for the year 2000 presented in “Healthy People 2000”(3) are relevant to the use of alcohol or other drugs among adolescents. These objectives helped guide our selection of the priority behavioral dimensions of alcohol and other drug use.

Among the risk reduction objectives that concern alcohol and other drug use, Objective 4.5 calls for increasing the average age of initiation among adolescents who use tobacco, alcohol, and marijuana. Achieving this objective is particularly important because early use is associated with faster escalation of use and greater involvement with these substances later in life (43).

Objective 4.6 calls for reducing the proportion of adolescents who have recently used alcohol, marijuana, and cocaine. These drugs, along with tobacco, are the most commonly used among youth and the focus of considerable public concern. Recent use may have serious implications for health status and school performance. Relatedly, Objective 4.7 calls for reducing binge drinking among high school seniors and college students.

Objective 4.11 calls for reducing steroid use among male adolescents. Because steroid users may not be part of the illegal drug culture, meeting this objective may require different types of intervention and prevention programs.

Additional risk reduction objectives call for reducing the per capita consumption of alcohol among people

‘Even infrequent use of alcohol or other drugs may result in intoxication and acute consequences, especially among youth, who may have low tolerance due to their smaller body size and may lack experience with the effects of alcohol and other drugs.’

ages 14 and older (Objective 4.8) and for increasing the proportion of high school seniors who perceive the social unacceptability of and the risks associated with heavy use of alcohol, occasional use of marijuana, and any use of cocaine (Objectives 4.9 and 4.10).

One relevant health status objective (Objective 4.1) calls for reducing deaths caused by alcohol-related motor vehicle crashes. People ages 15-24 are singled out as one of two age groups that suffer disproportionate mortality from alcohol-related motor vehicle crashes.

Five services and protection objectives concern alcohol and other drug use among adolescents. They call for more treatment programs for traditionally underserved populations including youth (Objective 4.12), education to prevent alcohol and other drug use as part of quality school health education (Objective 4.13), policies to reduce minors’ access to alcoholic beverages (Objective 4.16), statutes to restrict sales promotion of alcoholic beverages that are focused principally on youth (Objective 4.17), and blood alcohol tolerance levels of zero for motor vehicle drivers younger than age 21 (Objective 4.18).

Priority Behaviors, Behavioral Dimensions

Use of alcohol and other drugs was rated as the priority behavior to measure. The Panel on Alcohol and Other Drug Use thus identified behavioral dimensions that increase the likelihood of adverse health outcomes from this behavior. The panel gave highest priority to four dimensions — type of drug used, frequency and chronicity of drug use, pattern of drug use, and age at onset of use. We designated three other behavioral dimensions — use in relation to other risk behaviors, dependent use, and amount consumed — as having lower priorities. We based our decisions on the contribution to adverse health outcomes, the relevance to national health objectives (3), and the desire to obtain information comparable with that collected from other surveys and data sets.

The type, frequency, chronicity, and pattern of drug use help to determine the short- and long-term health outcomes, likelihood of dependency, and type and duration of prevention and treatment programs. The age

'Analyses of differences in drug use among age, sex, and race or ethnicity groups will be valuable in targeting drug education programs for youth. This information also can help provide focus for drug education programs in the United States.'

at onset of drug use is important because early use is associated strongly with subsequent patterns of use and adverse health outcomes. Early use of three “gateway” drugs — tobacco, alcohol, and marijuana — may predict subsequent and more serious involvement with all types of drugs (43). Use of drugs early in life also is associated with other problems, such as suicide, homicide, motor vehicle crashes, early sexual intercourse, sexually transmitted diseases, school dropout, and delinquency (44,45).

YRBSS Questions

We developed 14 questions to measure the selected behavioral dimensions of alcohol and other drug use (see Appendix II, Youth Risk Behavior Surveillance System, for the specific questions, page 60). Type of drug use is measured with nine questions; six of them focus on the use of alcohol (Nos. 33 and 34), marijuana (Nos. 37 and 38), and any form of cocaine (Nos. 40 and 41). We designed a separate question, No. 42, to measure the use of crack or freebase forms of cocaine specifically, because of their impact on adolescents. Another question, No. 43, collectively addresses all other illegal drugs, including LSD, PCP, ecstasy, mushrooms, speed, ice, heroin, or pills without a physician’s prescription. Question No. 44, on type of drug use, addresses steroid use. This question can be used to measure Objective 4.11.

Frequency or chronicity of drug use is measured as part of the same nine questions (Nos. 33, 34, 37, 38, 40, 41, 42, 43, and 44) that measure type of drug. These questions focus on how many days or how many times the respondent used each type of drug. Because even a single use places all users — particularly adolescents — potentially at risk for negative health outcomes, we chose “lifetime” as the recall period for all types of drugs. To be consistent with Objective 4.6 (3) and other data sets (46), we also selected a “30-day” recall period to measure current use of alcohol, marijuana, and cocaine. These two recall periods provide estimates comparable to results from Monitoring the Future: A Continuing Study of the Lifestyles and Values of Youth, a project funded by a grant from the National Institute on Drug Abuse. Monitoring the Future includes an annual

school-based survey of 12th grade students that has been conducted since 1975 by the Institute of Social Research at the University of Michigan. Since 1991, Monitoring the Future also has included 8th and 10th grade students. Comparability of results is further enhanced by the similar response categories used in the two systems’ questionnaires.

Age at onset is measured with three questions (Nos. 32, 36, and 39). To be consistent with Objective 4.5 (3), alcohol, marijuana, and cocaine are the focus of these questions. Because the age of students in any particular grade tends to vary, comparability with Monitoring the Future (46), which measures grade at onset for the same three drugs, will be somewhat limited.

Patterns of drug use are measured with two questions that focus on two particularly dangerous behaviors: episodic heavy drinking and injection of illegal drugs. Episodic heavy drinking is associated strongly with motor vehicle crashes, physical fights, destroyed property, and academic troubles. Question No. 35 defines episodic heavy drinking as having five or more drinks in a row — an operational definition consistent with the one used in Monitoring the Future (46). However, the “30-day” recall period selected for this YRBSS question, although consistent with that used in other YRBSS questions, will limit comparability with the “2-week” recall period used in questions measuring heavy drinking in Monitoring the Future (46). This question can be used to measure Objective 4.7.

Drug injection is one of the major routes of HIV infection. “Lifetime” was selected as the recall period for question No. 45 because even a single instance of drug injection may place an adolescent at risk for HIV infection as well as for other negative health outcomes.

Another dimension, drug use in relation to other risk behaviors, is measured, to some extent, within other categorical areas of the YRBSS questionnaire. The frequency of riding in a car or other vehicle driven by someone who had been drinking alcohol (No. 11) and the frequency of driving a car or other vehicle while drinking alcohol (No. 12) are measured by the YRBSS questions that deal with unintentional injuries (see “Measuring Adolescent Behaviors Related to Unintentional Injuries” beginning on page 11). The YRBSS questionnaire also measures another important relationship by asking about alcohol and other drug use before having sexual intercourse (No. 52) (see “Measuring Adolescent Sexual Behaviors and Related Health Outcomes” beginning on page 31). The limited number of questions on alcohol and other drug use that could be included in the YRBSS precluded questions that would measure other important aspects of this dimension, such as alcohol and other drug use associated with physical fighting and aggressive behavior, illegal activi-

ties, and absenteeism at school or work. Similarly, dependent drug use and amount of drug use are not measured.

Because the questionnaire was designed to focus primarily on behaviors, we did not include questions to measure knowledge and attitudes about drug use, perceived risk of harm related to drug use, parental drug use, and perceptions about available services, programs, and policies that attempt to prevent or reduce adolescent drug use.

Discussion

Recognition of the impact of alcohol and other drug use in the United States can help mobilize families, schools, official agencies, communities, and businesses to address this problem. Information on the prevalence of alcohol and other drug use among adolescents can be used to increase awareness of the problem and then monitor progress in reducing substance use over time.

These YRBSS questions will provide important information about the nature and extent of major behavioral dimensions of alcohol and other drug use among adolescents and about whether these dimensions change over time. Analyses of differences in drug use among age, sex, and race or ethnicity groups will be valuable in targeting drug education programs for youth. This information also can help provide focus for drug education programs in the United States.

Drug education conducted as a part of quality school health education should provide factual information about the harmful effects of drugs and teach young people skills to avoid using them. School policies that support substance-free campuses and provide referral to drug treatment and support groups can reinforce classroom programs (3).

Although the responses to alcohol and other drug use questions in the YRBSS do not provide an in-depth description of drug use, the system will enable assessment of the relationships among this area of health risk and the other five categories of risk measured by the YRBSS. Information about the interrelatedness of health risk behaviors is critical in developing comprehensive programs that will be effective in reducing health risks among adolescents throughout the United States.

References.....

1. Public Health Service: National Household Survey on Drug Abuse: population estimates, 1991. DHHS Publication No. (ADM) 92-1887, Washington, DC, 1991.
2. Rice, D. P., Kelman, S., Miller, L. S., and Danmeyer, S.: The economic costs of alcohol and drug abuse and mental illness, 1985. DHHS Publication No. (ADM) 90-1694, Washington, DC, 1990.
3. Public Health Service: Healthy people 2000: national health promotion and disease prevention objectives—full report, with commen-

4. Newcomb, M. D., and Bentler, P. M.: Consequences of adolescent drug use: impact on the lives of young adults. Sage Publications, Newbury Park, CA, 1988.
5. National Center for Health Statistics: Advance report of final mortality statistics, 1989. Monthly Vital Stat Rep 40 (supp. 2), No. 8, Hyattsville, MD, Jan. 7, 1992, pp. 1-52.
6. Perrine, M., Peck, R., and Fell, J.: Epidemiologic perspectives on drunk driving. In Surgeon General's Workshop on Drunk Driving: background papers. U.S. Department of Health and Human Services, Washington, DC, 1988, pp. 35-76.
7. Alcohol-related traffic fatalities among youth and young adults — United States, 1982-1989. MMWR 40: 178-187, Mar. 22, 1991.
8. Centers for Disease Control. HIV/AIDS surveillance report — January 1992. Atlanta, GA, 1992.
9. Stall, R., et al.: Alcohol and drug use during sexual activity and compliance with safe sex guidelines for AIDS: the AIDS Behavioral Research Project. Health Educ Q 13: 359-371 (1986).
10. Fullilove, R. E., Fullilove, M. T., Bowser, B. P., and Gross, S. A.: Risk of sexually transmitted disease among black adolescent crack users in Oakland and San Francisco, California. JAMA 263: 851-855, Feb. 9, 1990.
11. Isner, J. M., et al.: Acute cardiac events temporally related to cocaine abuse. N Engl J Med 315: 1438-1443, Dec. 4, 1986.
12. Jonas, J. M., Gold, M. S., Sweeney, D., and Pottash, A. L. C.: Eating disorders and cocaine abuse: a survey of 259 cocaine abusers. J Clin Psychiatry 48: 47-50 (1987).
13. Washton, A. M., and Gold, M. S.: Crack. JAMA 256: 311, Aug. 8, 1986.
14. Handelman, G. E., Contreras, P. C., and O'Donahue, T. L.: Selective memory impairment by phencyclidine in rats. Eur J Pharmacol 140: 69-73 (1987).
15. U.S. Department of Health and Human Services: Adolescent steroid use. DHHS Publication No. (OEI) 06-90-01080, Washington, DC, 1991.
16. Amsel, Z., Genser, S. G., and Haverkos, H. W.: Anabolic steroid use among male high school seniors. JAMA 261: 2639-2640, May 12, 1989.
17. Abel, E. L., and Sokol, R. J.: Fetal alcohol syndrome is now leading cause of mental retardation. [letter] Lancet No. 8517: 1222, Nov. 22, 1986.
18. Rosett, H. L.: A clinical perspective of the fetal alcohol syndrome. Alcohol 4: 119-122 (1980).
19. Abel, E. L., and Sokol, R. J.: Incidence of fetal alcohol syndrome and economic impact of FAS-related anomalies. Drug Alcohol Depend 19: 51-70 (1987).
20. Fried, P. A., and Makin, J. E.: Neonatal behavioral correlates of prenatal exposure to marijuana, cigarettes, and alcohol in a low risk population. Neurotoxicology Teratol 9: 1-7 (1987).
21. Chasnoff, I. J., et al.: Temporal patterns of cocaine use in pregnancy. JAMA 261: 1741-1744, Mar. 24/31, 1989.
22. Jones, C. L., and Lopez, R. E.: Direct and indirect effects on the infant of maternal drug use. In New perspectives on prenatal care, Elsevier, New York, 1990, pp. 273-318.
23. Public Health Service: Seventh special report to the U.S. Congress on alcohol and health. DHHS Publication No. (ADM) 90-1656, Washington, DC, 1990.
24. Altura, B. M.: Introduction to the symposium and overview. Alcohol 10: 557-559 (1986).
25. Klatsky, A. L.: The cardiovascular effect of alcohol. Alcohol Alcohol 22 (supp. 1): 117-124 (1987).
26. Driver, H. E., and Swann, P. F.: Alcohol and human cancer. [review]. Anticancer Res 7: 309-320 (1987).
27. Miller, N. S., and Gold, M. S.: The diagnosis and treatment of alcohol dependence. N J Med 84: 873-879 (1987).
28. Mutchnick, M. G., and Lee, H. H.: Impaired lymphocyte proliferation. DHHS Publication No. (PHS) 91-50212, Washington, DC, 1991.

- tive response to mitogen in alcoholic patients. Absence of a relation to liver disease activity. *Alcohol* 12: 155-158 (1988).
29. Hegedus, L.: Decreased thyroid gland volume in alcoholic cirrhosis of the liver. *J Clin Endocrinol Metab* 58: 930-933 (1984).
 30. Noth, R. H., and Walter, R. M., Jr.: The effects of alcohol on the endocrine system. *Med Clin North Am* 68: 133-146 (1984).
 31. Johnston, D. E., Chiao, Y. B., Gavaler, J. S., and Van Thiel, D. H.: Inhibition of testosterone synthesis by ethanol and acetaldehyde. *Biochem Pharmacol* 30: 1827-1831 (1981).
 32. Kurata, J. H., and Halle, B. E.: Epidemiology of peptic ulcer disease. *Clin Gastroenterol* 13: 289-307 (1984).
 33. Van Thiel, D. H., et al.: Gastrointestinal and hepatic manifestations of chronic alcoholism. *Gastroenterol* 81: 594-615 (1981).
 34. Public Health Service: The Surgeon General's report on nutrition and health. DHHS Publication No. (PHS) 88-50210, Washington, DC, 1988.
 35. Gong, H., Jr., Fligiel, S., Tashkin, D. P., and Barbers, R. G.: Tracheobronchial changes in habitual, heavy smokers of marijuana with and without tobacco. *Am Rev Respir Dis* 136: 142-149 (1987).
 36. Barbers, R. G., et al.: Differential examination of bronchoalveolar lavage cells in tobacco cigarette and marijuana smokers. *Am Rev Respir Dis* 135: 1271-1275 (1987).
 37. McSherry, T. M.: Program experiences with the solvent abuser in Philadelphia. *In* *Epidemiology of inhalant abuse: an update*, edited by R. A. Crider and B. A. Rouse. National Institute on Drug Abuse Research Monograph 85, DHHS Publication No. (ADM)88-1577, Washington, DC, 1989, pp. 106-120.
 38. Ron, M. A.: Volatile substance abuse: a review of possible long-term neurological, intellectual, and psychiatric sequelae. *Br J Psychiatry* 148: 235-246 (1986).
 39. Commins, D. L., et al.: Biochemical and histological evidence that methylenedioxyamphetamine (MDMA) is toxic to neurons in the rat brain. *J Pharmacol Exp Ther* 241: 338-345 (1987).
 40. Ross, H. E., Glaser, F. B., and Germanson, T.: The prevalence of psychiatric disorders in patients with alcohol and other drug problems. *Arch Gen Psychiatry* 45: 1023-1031 (1988).
 41. Galanter, M., Castaneda, R., and Ferman, J.: Substance abuse among general psychiatric patients: place of presentation, diagnosis and treatment. *Am J Drug Alcohol Abuse* 14: 211-235 (1988).
 42. Helzer, J.: Psychiatric diagnoses and substance abuse in the general population: the ECA data. *In* *Problems of drug dependence 1987*, edited by L. S. Harris. National Institute on Drug Abuse Research Monograph 81. DHHS Publication No. (ADM) 88-1564, Washington, DC, 1988, pp. 405-415.
 43. Yamaguchi, K., and Kandel, D. B.: Patterns of drug use from adolescence to early adulthood. II: Sequence of progression. *Am J Public Health* 74: 668-678 (1984).
 44. Jessor, R., and Jessor, S. L.: Theory testing in longitudinal research on marijuana use. *In* *Longitudinal research on drug use*, edited by D. B. Kandel. Washington, DC, Hemisphere Publishing Corp., 1978, pp. 41-71.
 45. Robins, L. N., and Przybeck, T. R.: Age of onset of drug use as a factor in drug and other disorders. *In* *Etiology of drug abuse: implications for prevention*, edited by C. L. Jones and R. J. Battjes. National Institute on Drug Abuse Research Monograph 56. DHHS Publication No. (ADM)85-1335, Washington, DC, 1985, pp. 178-192.
 46. Johnston, L. D., O'Malley, P. M., and Bachman, J. G.: Drug use among American high school seniors, college students, and young adults, 1975-1990. DHHS Publication No. (ADM) 91-1813, Washington, DC, 1991.