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Comparative Epidemiology of Dependence on Tobacco, Alcohol, Controlled Substances, and Inhalants: Basic Findings From the National Comorbidity Survey

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Studying prevalence of *Diagnostic and Statistical Manual* (3rd ed., rev., American Psychiatric Association, 1987) drug dependence among Americans 15–54 years old, we found about 1 in 4 (24%) had a history of tobacco dependence; about 1 in 7 (14%) had a history of alcohol dependence; and about 1 in 13 (7.5%) had a history of dependence on an inhalant or controlled drug. About one third of tobacco smokers had developed tobacco dependence and about 15% of drinkers had become alcohol dependent. Among users of the other drugs, about 15% had become dependent. Many more Americans age 15–54 have been affected by dependence on psychoactive substances than by other psychiatric disturbances now accorded a higher priority in mental health service delivery systems, prevention, and sponsored research programs.

The aim of this article is to report basic descriptive findings from new research on the epidemiology of drug dependence syndromes, conducted as part of the National Comorbidity Survey (NCS). In this study, our research team secured a nationally representative sample and applied standardized diagnostic assessments in a way that allows direct comparisons across prevalence estimates and correlates of tobacco dependence, alcohol dependence, and dependence on other psychoactive drugs (Kessler et al., 1994).

For this overview of the survey's findings, a primary goal has been to answer two basic epidemiologic questions about drug dependence involving tobacco, alcohol, controlled drugs such as cocaine, and inhalants: First, in the population under study, what proportion of persons now qualifies as a currently active or former case of drug dependence? Second, where are the affected cases more likely to be found within the sociodemographic structure of the study population?

In addition, population estimates presented in this article shed light on the epidemiology of dependence on tobacco, alcohol, and the following individual drugs and drug groups: cannabis; heroin; cocaine; psychostimulants other than cocaine; analgesic drugs; a drug group consisting of anxiolytic, sedative, and hypnotic drugs; psychedelic drugs; and inhalant drugs. The following population estimates are presented for each of these listed drugs, including tobacco and alcohol: (a) lifetime prevalence of drug dependence, evaluated in relation to criteria published in the *Diagnostic and Statistical Manual of Mental Disorders*, Third Edition, Revised (DSM–III–R; American Psychiatric Association, 1987); (b) lifetime prevalence of extramedical drug use, defined to encompass illicit drug use as well as patients taking prescribed medicines to get

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high, taking more than was prescribed, or taking medicines for other reasons not intended by the doctor; and (c) the proportion of extramedical users who had become drug dependent.

Using estimates such as these, we seek to describe the broad population experience with forms of psychoactive drug use that generally occur without scrutiny or control by prescribers, pharmacists, or other health practitioners. Although conceding many reasons people might deny or underreport their illicit drug use or drug problems, we draw attention to how often illicit drug use and symptoms of drug use disorders are acknowledged in survey research of this type. For example, on the basis of confidential interviews conducted for the Epidemiologic Catchment Area (ECA) survey more than 10 years ago, we found that one in three adult Americans (30.5%) reported a history of recent or past illicit drug use. On the basis of self-report alone, 20% of these illicit drug users had a history of dependence on controlled substances or a related drug disorder. Not counting tobacco dependence, about one in six adult Americans (17%) met diagnostic criteria for either an alcohol or drug disorder, or both (Anthony & Helzer, 1991). These are substantial estimates that convey the public health significance of drug use and drug dependence in the United States, and they are far too large to be due to the type of exaggeration and overreporting sometimes found in surveys of drug use in early adolescence (Johnston, O'Malley, & Bachman, 1992). If a correction could be made for underreporting, these substantial estimates would be even larger.

In the 14 years since the start of the ECA surveys, the population's drug experience has changed in important ways, with passage through a now-subsiding epidemic of crack smoking and other cocaine use (Harrison, 1992; Kandel, 1991). The NCS chronicles results of these changes and draws strength from some methodological refinements that were not part of the ECA research plan: (a) a nationally representative sample of 15–54-year-olds; (b) a more complete assessment of extramedical drug use, applying measurement strategies developed for the National Household Survey on Drug Abuse (NHSDA; U.S. Department of Health and Human Services [USDHHS], 1993); (c) deliberate alignment of diagnostic criteria and the measurement strategies used to assess dependence on alcohol, tobacco, and other drugs, so as to allow comparisons across drug groups; and (d) more thorough adjustment for nonresponse biases introduced by designated respondents who declined to be assessed, perhaps for reasons connected to alcohol or drug dependence.

The descriptive estimates presented in this overview set the stage for ongoing research in which we are testing hypotheses about suspected determinants and consequences of drug dependence, including links between drug dependence and other psychiatric conditions such as anxiety and mood disorders (Kessler, in press). These findings may interest pharmacologists and other scientists who are concerned about the population's drug experience outside the boundaries of laboratory and clinical research and practice. Those who study the reinforcing functions of drug use and dependence liability of individual drugs may gain useful insights by considering comparative aspects of the epidemiology of tobacco, alcohol, and other drug dependence, including epidemiologic evidence on the transition from a single occasion of drug use toward the development of drug dependence, a topic of considerable interest within the clinical and research community (e.g., see Anthony, 1991; Glantz & Pickens, 1992; Henningfield, 1992). Investigators also will find these population estimates useful as they seek to substantiate the potential public health significance of their pharmacologic studies or to analyze public policies. Finally, these estimates may have value for primary care practitioners and family doctors, as well as psychologists, psychiatrists, or other specialists who prescribe psychoactive drugs or who need to anticipate how frequently the health status of their patients might be complicated by a history of dependence on tobacco, alcohol, or other drugs.

Method and Materials

The NCS was based on a stratified, multistage area probability sample of persons 15 to 54 years old in the noninstitutionalized civilian population in the 48 coterminous United States, including a representative sample of students living in campus group housing. Fieldwork was carried out by the professional field staff of the Survey Research Center at the University of Michigan between September 14, 1990 and February 6, 1992. To allow midcourse adjustments and adaptation to unanticipated problems, the fieldwork was organized in

relation to timed release of six replicate subsamples, each designed to be representative of the study population. Overall response rate was 82.4%, with a total of 8,098 participants. A more detailed discussion of the NCS sampling design and its implementation has been given by Kessler et al. (1994).

After sampling, 1 of the 158 specially trained survey interviewers met with each designated respondent to administer the Composite International Diagnostic Interview (CIDI), as adapted for the NCS to yield detailed information about a broad range of psychiatric disorders, including drug dependence (Cottler et al., 1991; Robins et al., 1988; Wittchen, in press). These interviewers participated in a 7-day study-specific training program in the use of the CIDI before beginning fieldwork. They were trained to follow a protocol intended to engage the designated respondents' interest in the survey and to reinforce survey participation; to secure a private location for the interview, which most often was within the place of residence; to develop trust and rapport with the respondent and to obtain informed consent before starting the interview; to administer the survey questions, as worded, in a fixed sequence; and to record each subject's responses in a precoded response booklet. The interviewers were not given special training in psychopathology or psychopharmacology, and they were not made aware of any key hypotheses under study or of our research team's interest in the reinforcing functions served by drug use. The highly structured and standardized interview schedule also was used to gather information on suspected correlates and consequences of psychiatric disorders, including educational attainment, occupation, and other characteristics of designated respondents or their households.

Because previous surveys have provided some evidence that survey nonrespondents have more psychiatric disorders than respondents, a supplemental nonresponse survey was conducted in tandem with the main NCS survey. This was done by selecting a random subsample of designated respondents who initially were not interviewed either because of refusal or (in rare cases) inability to contact after many attempts. These persons were asked to complete a short-form version of the diagnostic interview.

Assessment of Alcohol and Other Drug Use

Respondents were asked separate questions on their use of alcoholic beverages, tobacco, and the other individual drugs and drug groups listed below. The survey questions on the frequency and recency of taking controlled substances and inhalants were nearly identical to standardized assessments developed for the NHSDA, now sponsored by the Office of Applied Studies within the Substance Abuse and Mental Health Services Administration. These questions clarified our focus on illicit use of Schedule I drugs such as marijuana, heroin, and LSD, as well as extramedical use of cocaine and other drugs that can be obtained through legitimate medical channels. They were phrased to encompass use of these drugs and medicines "on your own, either without your own prescription from a doctor, or in greater amounts or more often than prescribed, or for any reason other than a doctor said you should take them" (USDHHS, 1993). In addition, respondents were asked whether they had started to feel dependent on a drug while taking it in accord with a doctor's prescription. Ensuing survey questions covered topics such as age of onset, frequency, and recency of extramedical drug use for each of the following individual drugs and drug groups, which were adapted from NHSDA conventions: heroin; other opioids and analgesics that can be obtained through medical channels (e.g., morphine, propoxyphene, codeine); cannabis (marijuana, hashish, or both); psychedelic drugs (e.g., LSD, peyote, mescaline); inhalant drugs (e.g., gasoline or lighter fluids, spray paints, amyl nitrite, nitrous oxide); cocaine (including crack cocaine and freebase); psychostimulants other than cocaine (e.g., dextroamphetamine, methamphetamine); and anxiolytic, sedative, and hypnotic drugs (e.g., secobarbital and diazepam, as well as more recently introduced compounds such as flurazepam, alprazolam, and triazolam).

Consistent with the NHSDA and ECA surveys, the NCS assessment strategy included a detailed verbal description of each drug group and lists of qualifying drugs that were read to each participant, but it did not include the NHSDA colored pill card with pictures of different pharmaceutical products. Furthermore, the NCS interviewer read the questions and recorded each participant's answers on a precoded response form. This approach was consis-

tent with prior ECA surveys on drug dependence but was in contrast with the NHSDA approach of allowing the respondent to self-administer survey questions on drug use. When interviewers administer the questions, it is possible to reduce the impact of low levels of literacy and reading achievement among participants and to use interview skip outs and branching patterns that can shorten the interview and distribute its coverage to other important topics such as suspected risk factors and use of mental health and other medical services. Although we acknowledge that some population groups may report more drug use when they self-administer NHSDA questionnaires (Schober, Caces, Pergamit, & Branden, 1992), we have made a direct comparison of NCS and 1991 NHSDA estimates, generally finding that the estimates were very close to one another, and that the NHSDA estimate always was located within the 95% confidence interval for the corresponding NCS estimate. We return to this topic in the Discussion section.

NCS questions on the use of alcoholic beverages followed a similar NHSDA format and elicited information about age of onset, frequency, recency, and quantity of drinking. Respondents also were asked whether they had consumed at least 12 drinks in any single year of their lives.

Diagnostic Assessment of Alcohol and Other Drug Dependence

The CIDI diagnostic assessment of alcohol and other drug dependence for the NCS was based on DSM–III–R criteria, translated into standardized survey questions for administration by a trained lay interviewer. As in the ECA program method used for Diagnostic Interview Schedule diagnoses (Robins, Helzer, Croughan, & Radcliff, 1985), each participant's answers to the survey questions have been recorded and converted to a machine-readable format, and a computer program has been used to determine whether the diagnostic criteria have been met. As summarized recently by Wittchen (in press), World Health Organization field trials and other methodological studies have provided evidence that the CIDI assessments for alcohol and other drug dependence have acceptable levels of interrater reliability and test–retest reliability, and generally are congruent with independently made standardized clinical diagnoses.

DSM–III–R criteria require evidence concerning nine manifestations of alcohol or other drug dependence grouped under the heading of Criterion A, modeled loosely after the original Edwards–Gross concept for an alcohol dependence syndrome (Edwards & Gross, 1976). The list of nine manifestations covers a range of signs or symptoms, such as those that occur in the context of a drug withdrawal syndrome, as well as behavioral manifestations of drug dependence such as unsuccessful attempts to stop or cut down on drug use, and sustained use despite recognition that it is related to social, psychological, or physical problems. To qualify for a DSM–III–R drug dependence diagnosis, at least three of these nine Criterion A manifestations must be met. In addition, Criterion B requires that the disturbance has persisted for at least one month or that presenting features of drug dependence have appeared repeatedly over a longer period of time. The CIDI includes two or more survey items designed to tap the domains represented by each of the nine Criterion A manifestations, as well as questions concerning Criterion B. The CIDI lifetime diagnosis for alcohol or other drug dependence is not made unless there is positive evidence that the respondent meets both Criterion A and Criterion B.

This assessment of alcohol or other drug dependence was administered whenever participants reported occasions of extramedical use of controlled substances or inhalants in their lifetimes, or when they reported consuming 12 or more drinks in any one year. For the assessment, identical standardized questions were asked for alcohol, controlled substances, and inhalants. By holding constant both the diagnostic criteria and the manner in which the criteria were assessed, we sought to reduce methodologic variation that otherwise might distort comparisons between alcohol and the other drugs. It was not possible to control for these differences in the ECA surveys (Anthony, 1991; Anthony & Helzer, 1991).

Two other methodologic contrasts between the ECA surveys and the NCS also should be mentioned in relation to controlled substances. First, in contrast with the NCS, the ECA surveys did not check for drug dependence (*Diagnostic and Statistical Manual of Mental Disorders,* 3rd ed., DSM–III; American Psychiatric Association, 1980) when a participant reported use of a medicine in accord with a doctor's prescription, even if that use had

led to feelings of dependence. Second, the NCS included inhalants when assessing drug dependence (DSM–III–R), whereas the ECA surveys did not. As in the ECA surveys, dependence was assessed whenever participants reported at least several occasions of extramedical drug use, under the assumption that even as few as six occasions might be sufficient for development of drug dependence, but that drug dependence would be extremely rare or improbable among persons who had used the drug no more than several times.

Assessment of Tobacco Use and Dependence

When the NCS fieldwork started, there were insufficient funds to allow NCS assessment of tobacco use and tobacco dependence during an already lengthy interview. Midway through fieldwork, supplemental funding and interview time became available for inclusion of a CIDI section on DSM–III–R tobacco dependence designed to be parallel to the CIDI assessment for DSM–III–R dependence on alcohol and other drugs, but also including a few standardized questions on behaviors specific to tobacco smoking. Because of the NCS replicate sampling plan, it was possible to administer the tobacco assessment to a representative subsample of NCS participants, consisting of 4,414 persons, or 55% of the total NCS sample.

This assessment of tobacco dependence included questions about daily tobacco smoking but not about more infrequent or irregular smoking. Special analyses of the 1991 NHSDA data have been completed to fill this gap of information. The 1991 NHSDA was conducted midway through the NCS fieldwork, with a nationwide probability sample of persons 12 years of age and older and with survey assessments of drug use already described in this article. The NHSDA survey questions ascertain whether tobacco cigarettes were smoked, even on a single occasion, so that the resulting estimates for tobacco use correspond to the NCS estimates on alcohol use on at least one occasion and extramedical use of other drugs on at least one occasion. To conform with the NCS, the NHSDA analyses were restricted to 15–54-year-olds.[1]

Quality Control Measures During Fieldwork

The interviewers were monitored by 18 regional supervisors responsible for editing completed interviews before they were forwarded to the national field office. In addition, central field office staff reviewed interviews as soon as they were received from supervisors. Whenever errors were found or important information was missing, the interview assignments were sent back to the field for resolution, and the respondents were recontacted to clarify their answers.

Analysis Procedures

We present survey-based population estimates for the lifetime prevalence of extramedical drug use and the lifetime prevalence of drug dependence in relation to alcohol, tobacco, and the other individual drugs or drug groups previously listed. Each prevalence estimate for drug use is a proportion in which the numerator consists of the estimated number of persons who have had at least one occasion of extramedical drug use in their lifetimes, whereas the denominator is the total study population. Each population prevalence estimate for drug dependence has the same denominator, but the numerator is the estimated number of persons who qualify for the CIDI lifetime diagnosis for drug dependence according to DSM–III–R criteria. In addition, we report for each individual drug or drug group estimated proportions of drug users in the study population who had developed drug dependence. In concept, these proportions may be regarded as estimates of the lifetime prevalence of drug dependence among users in the study population. Algebra can be used to show that each proportion is equal to the lifetime prevalence of drug dependence in the study population, divided by the lifetime prevalence of drug use in the study population. Because we had to rely on NHSDA estimates for tobacco use, it was necessary to apply the algebraic method when we estimated the proportion of tobacco smokers who had developed tobacco dependence, and standard errors have not been estimated for these tobacco estimates.

We also present estimates for the strength of association between drug dependence and plausible determinants of drug dependence, including fixed characteristics such as birth year (age) and

[1] These NHSDA analyses were conducted by Howard Chilcoat at the Etiology Branch of the National Institute on Drug Abuse, Addiction Research Center.

sex, as well as potentially modifiable characteristics such as employment status; Table 1 gives a frequency distribution for each variable considered in this analysis on the basis of unweighted NCS sample data. To index the strength of association between drug dependence and each variable listed in Table 1, we have produced an estimate for the odds ratio. When a particular characteristic has no association with being a currently or formerly active case of drug dependence, the odds ratio estimate will be 1.0, or indistinguishable from 1.0 within the limits of survey precision. An odds ratio above 1.0 signals a positive association, whereas an odds ratio between 0.0 and 1.0 signals an inverse association (Fleiss, 1981). The odds ratios for this analysis have been estimated using logistic regression models and the Statistical Analysis System's PROC LOGISTIC (SAS Institute, 1988).

Aside from the unweighted sample data given in Table 1, all results reported in this article are based on conventional procedures for analysis of complex sample survey data. We have used weights to compensate for variation in sample selection probabilities as well as poststratification adjustment factors that compensate for survey nonresponse as well as other potential sources of survey error. Corresponding weights and poststratification adjustment factors also have been taken into account in the 1991 NHSDA estimates for tobacco use reported hereinafter.

Because of the complex sample design and weighting, standard errors of proportions were estimated using the Taylor series linearization method (Woodruff & Causey, 1976). The PSRATIO program in the OSIRIS IV statistical analysis and data management package was used to make these calculations (University of Michigan, 1981). Standard errors of odds ratios were estimated using the method of Balanced Repeated Replication in 44 design-based balanced subsamples (Kish & Frankel, 1970). These analytic procedures have been described in more detail by Kessler et al. (1994).

Results

How Many 15–54-Year-Old Americans Have Developed Drug Dependence?

Table 2 shows lifetime prevalence estimates and a standard error for each estimate on the basis of CIDI interviews administered to the 15–54-year-old NCS study population between late 1990 and early 1992. According to Table 2 (see column 2), an estimated 24.1% of this study population had developed tobacco dependence (±1.0%), whereas 14.1% had developed alcohol dependence (±0.7%), and 7.5% (±0.4%) had developed dependence on at least one of the controlled substances or inhalant drugs listed in Table 2. Thus, in rank order, a history of tobacco dependence appeared most frequently in this study population, affecting about 1 in 4 persons. Alcohol dependence was next most prevalent, having affected about 1 in 7 persons. A history of dependence on other drugs followed, in aggregate having affected about 1 in 13 persons.

Not counting tobacco and alcohol, cannabis accounted for more dependence than any other drug or drug group: In the NCS study population, 4.2% qualified for the lifetime diagnosis of cannabis dependence (Table 2, row 4, column 2). Dependence on cocaine, including crack cocaine, was next in rank: An estimated 2.7% of the 15–54-year-old study population had developed cocaine dependence. Prevalence estimates for only two other drug categories were above 1.0%: Dependence on psychostimulants other than cocaine (e.g., amphetamines) was 1.7%, and dependence upon anxiolytic, sedative, or hypnotic drugs was 1.2% (Table 2, row 7, column 2).

Within the Study Population, Where Was Drug Dependence Found?

Drug dependence was not distributed randomly within the study population; some groups were affected more than others. This can be seen in Table 3 in which logistic regression was used to produce odds ratio estimates that show the strength of association between drug dependence and various selected prevalence correlates such as age and sex.

Sociodemographic Variation: Sex, Age, and Race–Ethnicity

Men were somewhat more likely than women to have been affected by dependence on alcohol and by dependence on controlled substances or inhalants, but not by tobacco dependence. When we compared the odds of dependence for men versus

Table 1
Description of National Comorbidity Survey Sample in Relation to Selected Characteristics

Characteristic	Men	Women	Total
Sex			
Male			3,847
Female			4,251
Age			
15–24	868	900	1,768
25–34	1,211	1,415	2,626
35–44	1,128	1,114	2,242
45+	640	822	1,462
Race			
White	2,931	3,153	6,084
Black	427	584	1,011
Hispanic	362	371	733
Other	127	143	270
Employment			
Working	3,029	3,010	6,039
Student	525	552	1,077
Homemaker	6	483	489
Other	287	206	493
Education (in years)			
0–11	739	735	1,474
12	1,228	1,451	2,679
13–15	947	1,185	2,132
16+	933	880	1,813
Income (in thousands of dollars)			
00–19	963	1,381	2,344
20–34	993	1,038	2,031
35–69	1,364	1,358	2,722
70+	527	474	1,001
Household composition			
Live alone	688	510	1,198
Live with spouse	2,025	2,319	4,344
Live with other	814	586	1,400
Live with parent	320	836	1,156
Marital status			
Married or cohabiting	2,051	2,359	4,410
Separated, widowed, or divorced	503	750	1,253
Never married	1,293	1,142	2,435
Religion			
Protestant	2,006	2,469	4,475
Catholic	1,063	1,187	2,250
No preference	301	292	593
Other	477	303	780
Region			
Northeast	722	831	1,553
Midwest	993	1,084	2,077
South	1,352	1,529	2,881
West	780	807	1,587
Urbanicity			
Metropolitan	1,702	1,886	3,588
Other urban	1,277	1,452	2,729
Nonurban	868	913	1,781

Note. Unweighted sample data from the National Comorbidity Survey in the coterminous United States, 1990–1992.

Table 2
Estimated Prevalence of Extramedical Use and Dependence in Total Study Population and Lifetime Dependence Among Users

Drug categories	Proportion with a history of dependence		Proportion with a history of extramedical use		Dependence among extramedical users	
	P	*SE*	*P*	*SE*	*P*	*SE*
Tobacco[a]	24.1	1.0	75.6	0.6	31.9	–
Alcohol	14.1	0.7	91.5	0.5	15.4	0.7
Other drugs	7.5	0.4	51.0	1.0	14.7	0.7
Cannabis	4.2	0.3	46.3	1.1	9.1	0.7
Cocaine	2.7	0.2	16.2	0.6	16.7	1.5
Stimulant	1.7	0.3	15.3	0.7	11.2	1.6
Anxiolytics, etc.[b]	1.2	0.2	12.7	0.5	9.2	1.1
Analgesics	0.7	0.1	9.7	0.5	7.5	1.0
Psychedelics	0.5	0.1	10.6	0.6	4.9	0.7
Heroin	0.4	0.1	1.5	0.2	23.1	5.6
Inhalants	0.3	0.1	6.8	0.4	3.7	1.4

Note. Weighted estimates from the National Comorbidity Survey data gathered in 1990–1992 for persons 15–54 years old (n = 8,098). Dash indicates data not estimated. P = Estimated prevalence proportion.
[a]n = 4,414. [b]Anxiolytics, sedatives, and hypnotic drugs, grouped.

the odds of dependence for women, the odds ratio was 2.81 for alcohol dependence (95% confidence interval [CI] = 2.29, 3.44) and 1.62 for controlled substances or inhalants (95% CI = 1.24, 2.13). In contrast, the observed odds ratio was 1.18 for tobacco dependence, no more than slightly greater than the odds ratio value (1.0) that is expected under the null hypothesis of no association. Moreover, the 95% CI for the association between tobacco dependence and sex had a span from 0.99 to 1.40, trapping the null value of 1.0. Thus, the evidence is balanced toward a male excess in the prevalence of dependence on alcohol, controlled substances, or inhalants within this study population, but not toward a male excess in prevalence of tobacco dependence.

With respect to age, a history of tobacco dependence was least common among 15–24-year-olds, whereas a history of dependence on alcohol, controlled substances or inhalants was least common among 45–54-year-olds. As shown in Table 3, the odds of tobacco dependence among 15–24-year-olds were about one-half the odds of tobacco dependence among 45–54-year-olds (odds ratio [OR] = 0.48; 95% CI = 0.35, 0.64). However, compared with 45–54-year-olds, tobacco dependence was no more common among 25–34-year-olds (OR = 0.96) or 35–44-year-olds (OR = 1.0).

In contrast, a history of alcohol dependence was least common among 45–54-year-olds. By comparison with these older adults, the 15–24-year-olds were an estimated 1.41 times more likely to qualify for a lifetime alcohol dependence diagnosis (OR = 1.41; 95% CI = 1.08, 1.84); the corresponding odds ratio was 1.65 for the 25–34-year-olds (95% CI = 1.27, 2.16) and for the 35–44-year-olds (95% CI = 1.35, 2.02).

A history of dependence on controlled substances or inhalants was most likely to be found among young adults, and was least likely to be found among 45–54-year-olds. By comparison with 45–54-year-olds, the estimated odds of dependence on these drugs were 2.64 times greater among 15–24-year-olds, 3.50 times greater among 25–34-year-olds, and 3.08 times greater among 35–44-year-olds.

Compared with White Americans, the African-American segment of the study population was less likely to have a history of tobacco dependence (OR = 0.59), alcohol dependence (OR = 0.35), or dependence on other drugs (OR = 0.54); Hispanic Americans also were less likely than White Americans to have a history of tobacco dependence, but this was not the case for alcohol dependence ($p > .05$) or dependence on other drugs ($p > .05$). These inverse associations between drug depen-

Table 3
Demographic Correlates of Tobacco, Alcohol, and Other Drug Dependence

Characteristic	Tobacco		Alcohol		Other Drugs	
	OR	95% CI	OR	95% CI	OR	95% CI
Sex						
Male	1.18	0.99, 1.40	2.81*	2.29, 3.44	1.62*	1.24, 2.13
Female	1.00	—	1.00	—	1.00	—
Age						
15–24	0.48*	0.35, 0.64	1.41*	1.08, 1.84	2.64*	1.28, 5.45
25–34	0.96	0.70, 1.33	1.65*	1.27, 2.16	3.50*	1.92, 6.38
35–44	1.00	0.80, 1.25	1.65*	1.35, 2.02	3.08*	1.64, 5.79
45+	1.00	—	1.00	—	1.00	—
Race						
White	1.00	—	1.00	—	1.00	—
Black	0.45*	0.33, 0.60	0.35*	0.25, 0.50	0.54*	0.37, 0.79
Hispanic	0.59*	0.38, 0.92	1.00	0.72, 1.39	0.86	0.56, 1.34
Other	0.61	0.36, 1.05	0.59	0.24, 1.42	0.53	0.20, 1.42
Employment						
Working	1.00	—	1.00	—	1.00	—
Student	0.45*	0.30, 0.67	0.72*	0.51, 0.99	0.69	0.46, 1.02
Homemaker	1.53*	1.08, 2.18	0.72*	0.56, 0.92	1.59*	1.00, 2.51
Other	1.81*	1.31, 2.48	2.39*	1.72, 3.33	3.31*	2.10, 5.21
Education (in years)						
0–11	1.68*	1.14, 2.46	1.53*	1.23, 1.91	1.50*	1.04, 2.16
12	1.85*	1.34, 2.54	1.45*	1.14, 1.84	1.47*	1.08, 1.98
13–15	1.47*	1.04, 2.08	1.36*	1.05, 1.76	1.32	0.89, 1.94
16+	1.00	—	1.00	—	1.00	—
Income (in thousands of dollars)						
00–19	1.36	0.99, 1.86	1.59*	1.17, 2.18	2.11*	1.35, 3.31
20–34	1.44*	1.05, 1.98	1.27	0.91, 1.78	1.43	0.85, 2.41
35–69	1.24	0.91, 1.69	1.23	0.87, 1.72	1.21	0.72, 2.05
70+	1.00	—	1.00	—	1.00	—
Household composition						
Live alone	1.00	—	1.00	—	1.00	—
Live with spouse	1.05	0.80, 1.38	0.49*	0.38, 0.64	0.59*	0.41, 0.85
Live with other	0.87	0.59, 1.28	0.52*	0.36, 0.74	0.67	0.44, 1.02
Live with parent	0.39*	0.28, 0.56	0.43*	0.32, 0.59	0.44*	0.28, 0.69
Marital status						
Married or cohabiting	2.14*	1.79, 2.57	0.98	0.80, 1.20	1.08	0.75, 1.54
Separated, widowed, divorced	2.12*	1.59, 2.84	1.31	0.98, 1.75	1.37	0.86, 2.17
Never married	1.00	—	1.00	—	1.00	—
Religion						
Protestant	0.77	0.57, 1.04	0.60*	0.45, 0.80	0.51*	0.36, 0.71
Catholic	0.70*	0.50, 0.99	0.56*	0.42, 0.75	0.46*	0.33, 0.65
No preference	1.00	—	1.00	—	1.00	—
Other	0.75	0.46, 1.25	0.77	0.54, 1.10	0.82	0.48, 1.39
Region						
Northeast	1.05	0.79, 1.42	1.36*	1.01, 1.82	1.25	0.88, 1.78
Midwest	1.04	0.76, 1.42	1.34*	1.03, 1.75	0.86	0.63, 1.16
South	1.00	—	1.00	—	1.00	—
West	0.93	0.69, 1.25	1.51*	1.07, 2.14	1.79*	1.31, 2.46
Urbanicity						
Metropolitan	0.79	0.58, 1.07	1.00	0.74, 1.36	1.92*	1.33, 2.77
Other urban	0.85	0.59, 1.22	1.08	0.82, 1.41	1.72*	1.18, 2.51
Nonurban	1.00	—	1.00	—	1.00	—

Note. Dashes indicate data not estimated. OR = odds ratio; CI = confidence interval.
*$p < .05$.

dence and being African American or Hispanic American also were found in multiple logistic regression analyses that held constant employment and two primary indicators of socioeconomic status: educational achievement and income (data not shown in a table).

Employment and Socioeconomic Status

To study variation in occurrence of drug dependence by employment status at the time of assessment, individuals who primarily were working for pay have been compared with students, homemakers, and others (e.g., those who had been recently laid off or terminated and not yet reemployed; other persons no longer in the active labor force). In comparison with employed workers, students generally were a lower lifetime prevalence group for dependence on tobacco (OR = 0.45) and alcohol (OR = 0.72), but not for other drugs such as marijuana, cocaine, or inhalants (OR = 0.69; $p > .05$). A history of alcohol dependence was observed less frequently among homemakers versus employed workers (OR = 0.72), but homemakers were somewhat more likely to have been affected by dependence on tobacco (OR = 1.53) and by dependence on other drugs (OR = 1.59). Prevalence of dependence on alcohol, tobacco, and other drugs was especially common among persons recently laid off but not yet reemployed and other individuals not working in the paid labor force at the time of the assessment. Compared with employed workers, these unemployed persons were an estimated 1.81 times more likely to have a history of tobacco dependence, 2.39 times more likely to have a history of alcohol dependence, and 3.31 times more likely to have a history of dependence on controlled substances or inhalants (Table 3). These moderately strong associations between unemployment and dependence on alcohol, tobacco, or other drugs also were found in multiple logistic regression analyses that held constant age, sex, education, income, and a selection of other potentially confounding variables (data not presented in a table).

Low educational achievement also had a moderately strong association with a history of dependence on tobacco, alcohol, or other drugs, with or without statistical adjustment using the multiple logistic regression model. For persons with 0–11 years of schooling compared with persons who went to school for more than 15 years, the history of tobacco dependence was associated with lower educational achievement (OR = 1.68), as was a history of alcohol dependence (OR = 1.53) and also a history of dependence on other drugs (OR = 1.50). A similar profile of modest but statistically significant associations was observed when comparing persons with 12 years of schooling to those with more than 15 years (Table 3).

It is interesting to note that lower educational achievement was associated with dependence on tobacco and alcohol even among persons who had completed more than 12 years of schooling. This can be seen in the odds ratios that contrast persons with 13–15 years of education with those who attended school for 16 years or more (for 13–15 years vs. 16+ years, OR = 1.47 for tobacco dependence; OR = 1.36 for alcohol dependence).

In general, a lower annual income was associated with having been affected by drug dependence (Table 3). For example, persons earning less than $20,000 per year were 2.11 times more likely to have a history of dependence on controlled substances or inhalants compared with persons whose annual income was $70,000 or more (95% CI = 1.35, 3.31). For tobacco dependence, the strongest association was observed in the contrast between persons with incomes of $20,000 to $34,000 per year versus those with annual income of $70,000 or more (OR = 1.43; 95% CI = 1.05, 1.98).

Household Composition

Most of the study population (n = 4,344) consisted of married persons living with a spouse (with or without other family members), but a considerable number of respondents (n = 1,198) were living alone in their households (see Table 1). Compared with those living alone, individuals living with their spouses were just as likely to have lifetime tobacco dependence (OR = 0.87), but were less likely to qualify as recent or past cases of alcohol dependence (OR = 0.49) or dependence on controlled drugs or inhalants (OR = 0.59), as presented in Table 3. Inverse associations also were observed for persons living with their parents in relation to tobacco, alcohol, and other drugs. In part, these inverse associations should be understood in relation to sex: Within the study population, a large majority of persons living with parents were women, as shown in Table 1.

Marital Status and Religious Preference

In this study population, there was a tendency for a history of tobacco dependence to be more common among persons who were currently married or living with partners as if married (see "married" in Table 3) and among formerly married individuals (separated, divorced, or widowed), and less common among persons who were never married; this was not the case for dependence on alcohol or other drugs (Table 3). On the other hand, there were fairly consistent associations involving religious preference, with a history of dependence found more frequently among persons who professed no religious preference, and by comparison, least frequently among Catholics (OR = 0.70 for tobacco; OR = 0.56 for alcohol; OR = 0.46 for other drugs). In addition, Protestants had lower prevalence of dependence on alcohol (OR = 0.60) and controlled substances or inhalants (OR = 0.51) in a contrast to persons with no religious preference, but the odds ratio estimate for tobacco dependence among Protestants was closer to the null value of 1.0 and the association was not statistically significant by conventional standards (OR = 0.77; $p > .05$).

Location of Residence

For dependence on controlled substances or inhalants, there were nonrandom distributions in relation to both region of the country and urban–nonurban location of residence. Compared with residents of states in the South, individuals living in the West were found to be an estimated 1.79 times more likely to have developed dependence on these drugs. Residents of metropolitan areas were most likely to have a history of dependence on controlled substances or inhalants (OR = 1.92), followed by residents of other urban areas (OR = 1.72), and residents of nonurban areas were least likely to have been drug dependent.

Alcohol dependence also was associated with region of the country, but not with metropolitan or other urban environments. In a comparison with residents of the South, the odds of alcohol dependence were about 50% greater among persons living in the West (OR = 1.51) and about 35% greater among persons living in the Northeast (OR = 1.36) or in the Midwest (OR = 1.34).

In contrast with dependence on alcohol or other drugs, tobacco dependence was distributed essentially at random in relation to region of the country and urbanicity. All of the tobacco odds ratios corresponding to region and urban and nonurban residence were close to the null value of 1.0 and the associated confidence intervals had spans from below 1.0 to above 1.0 (Table 3).

Drug Use and the Transition to Drug Dependence

Lifetime prevalence proportions for drug dependence in the study population are determined in part by how many persons have tried each type of drug at least once and survived to be interviewed, and in part by how many of these surviving drug users had proceeded to become drug dependent. For example, considerably fewer members of the study population had tried tobacco than alcohol (75.6% lifetime prevalence for tobacco use vs. 91.5% for alcohol use, as shown in Table 2, column 4). However, dependence was more likely to occur among tobacco smokers than among alcohol drinkers: Of the tobacco smokers, 31.9% had developed tobacco dependence, whereas only 15.4% of the alcohol drinkers had developed alcohol dependence (Table 2, column 6). In consequence, within the total study population, the lifetime prevalence of tobacco dependence (24.1%) was greater than the lifetime prevalence of alcohol dependence (14.1%), even though more persons had consumed alcohol (91.5%) than had smoked tobacco (75.6%).

When controlled substances and inhalants were considered as a single group, the data showed that slightly more than one half of the study population had taken one or more of these drugs for extramedical reasons (51.0%) and 14.7% of the users had developed dependence on at least one of the listed drugs (Table 2, row 3, columns 4 and 6). Nonetheless, one might expect considerable variation in the prevalence of extramedical drug use and in the transition from drug use to drug dependence, across individual drugs and drug groups.

After alcohol and tobacco, cannabis was the next most frequently used drug listed in Table 2, but it ranked low in relation to our index of dependence among users (Table 2, column 6). Within the study population, an estimated 46.3% had used cannabis at least once, but only 9.1% of the users had developed cannabis dependence: For every user with a history of cannabis depen-

dence, there were 10 users who had not become dependent. By comparison, an estimated 16.2% of the study population had tried cocaine at least once, and 16.7% of them had qualified as cocaine dependent: For each cocaine user with a history of cocaine dependence, there were 5 users who had not become dependent (Table 2, columns 4 and 6).

An estimated 15.3% had used psychostimulants other than cocaine (e.g., amphetamines) for extramedical reasons, and 11.2% of these users had progressed to develop dependence on these drugs. Corresponding estimates for the anxiolytic, sedative, or hypnotic drugs were 12.7% and 9.2%, respectively. An estimated 9.7% of the study population had used analgesic drugs for extramedical reasons; 7.5% of these analgesic users had become dependent (Table 3, columns 4 and 6).

An estimated 10.6% of the 15–54-year-old study population reported using psychedelic drugs at least once, 6.8% reported use of inhalants, and 1.5% reported using heroin. An estimated 4.9% of the psychedelics users qualified for the dependence diagnosis. Among inhalant users, an estimated 3.7% qualified as dependent. By comparison, among heroin users in this sample, 23.1% had become dependent (Table 2).

Age and Drug Dependence by Drug Group

To some extent, age-associated variation in drug dependence that was observed in our logistic regression analyses should be understood in relation to differences in prevalence of drug use, in addition to other factors. For example, a history of tobacco use was less common among 15–24-year-olds as compared with older age groups (see Table 4 and Figure 1); this by itself might be sufficient to account for lower lifetime prevalence of tobacco dependence in the comparison of young versus older persons. However, the NCS data also highlighted the importance of age-related differences in the transition from tobacco use to tobacco dependence. In analyses that considered smokers only, we found that 15–24-year-old smokers were less likely than older smokers to have developed tobacco dependence (Table 4 and Figure 1).

For two groups of medically prescribed drugs, namely, the analgesics and the anxiolytic, sedative, and hypnotic drugs, the survey-based estimates for lifetime prevalence of dependence were higher for older age groups versus the youngest age group, despite generally lower prevalence of extramedical use among older adults. This was true for lifetime prevalence of dependence among extramedical users of these drugs as well as for lifetime prevalence of dependence among all persons (Table 4 and Figure 1).

A substantially different pattern was observed for marijuana, cocaine, psychostimulants other than cocaine, and the psychedelic drug group, which showed comparatively lower lifetime prevalence of dependence in the oldest age group, along with generally lower lifetime prevalence of extramedical drug use (Table 4 and Figure 1).

Alcohol offered a unique profile, with 45–54-year-olds having a relatively high lifetime prevalence of alcohol use (93.1%) but a relatively low prevalence of alcohol dependence (10.1%) as compared with the other age groups. Alcohol also is noteworthy because the lifetime prevalence of dependence among drinkers was about 10% for persons 45–54 years of age, considerably less than estimates of about 16% that were observed for all three younger age groups (Table 4 and Figure 1).

Drug Dependence by Drug Group and by Sex

In relation to lifetime prevalence of drug dependence and lifetime prevalence of extramedical use, the rank ordering of individual drugs and drug groups was generally identical for men and women (Table 5 and Figures 2 and 3). The exception can be seen in relation to a sex difference in the ranking of psychedelic drugs, which had been taken by 14.1% of men as compared with 7.2% of women.

In respect to 6 out of 10 individual drugs or drug groups, the lifetime prevalence estimates for dependence among users were roughly similar for men and women. For example, slightly more than 30% of the tobacco smokers had developed tobacco dependence, and slightly more than 22% of the heroin users had developed heroin dependence—regardless of sex. Minimal male-female differences in the prevalence of dependence among users were observed for cocaine, analgesics, hallucinogens, and inhalants (Table 5 and Figure 4).

In contrast, for alcohol and cannabis, male users were somewhat more likely than female users to have developed dependence (Table 5 and Figure 4). Furthermore, with respect to the drug group that included anxiolytics, sedatives, and hypnotics,

Table 4
Estimated Prevalence Proportion (P) of Extramedical Use and Dependence in Total Study Population and Lifetime Dependence Among Users by Age

Drug and age (years)	Proportion with a history of extramedical use		Proportion with a history of dependence		Dependence among users	
	P	*SE*	*P*	*SE*	*P*	*SE*
Tobacco[a]						
15–24	64.4	1.1	15.2	1.7	23.6	—
25–34	76.4	0.8	26.5	2.1	34.7	—
35–44	80.1	1.3	27.2	1.5	34.0	—
45+	82.7	1.4	27.2	2.3	32.9	—
Total	75.6	0.6	24.1	1.0	31.9	—
Alcohol						
15–24	82.5	1.1	13.6	1.1	16.5	1.3
25–34	95.0	0.7	15.6	1.1	16.4	1.1
35–44	94.9	0.8	15.6	1.0	16.4	1.0
45+	93.1	0.8	10.1	1.0	10.7	1.1
Total	91.5	0.5	14.1	0.7	15.4	0.7
Cannabis						
15–24	36.5	2.1	5.6	0.9	15.3	2.3
25–34	61.6	1.8	5.0	0.5	8.1	0.7
35–44	52.1	1.6	4.4	0.7	8.5	1.3
45+	25.5	1.9	0.8	0.4	3.1	1.5
Total	46.3	1.1	4.2	0.3	9.1	0.7
Cocaine						
15–24	10.6	1.0	2.6	0.6	24.5	4.8
25–34	26.9	1.6	4.2	0.4	15.5	1.9
35–44	17.2	1.4	2.6	0.4	15.3	2.4
45+	4.4	0.7	0.5	0.3	11.8	6.0
Total	16.2	0.6	2.7	0.2	16.7	1.5
Stimulants						
15–24	11.5	1.1	1.6	0.4	13.5	2.9
25–34	20.3	1.1	2.8	0.7	13.9	3.2
35–44	18.7	1.1	1.4	0.3	7.7	1.7
45+	7.2	0.8	0.5	0.2	6.5	2.0
Total	15.3	0.7	1.7	0.3	11.2	1.6
Anxiolytics, etc.[b]						
15–24	8.6	0.9	0.2	0.1	2.1	1.1
25–34	16.0	1.2	1.1	0.3	6.8	2.0
35–44	16.0	0.9	1.9	0.4	11.7	2.4
45+	8.0	1.0	1.6	0.6	20.3	6.9
Total	12.7	0.5	1.2	0.2	9.2	1.1
Analgesics						
15–24	10.9	1.0	0.2	0.1	1.6	0.7
25–34	12.0	0.8	0.8	0.1	6.8	1.0
35–44	9.1	0.8	1.0	0.2	11.5	2.9
45+	5.3	0.9	0.9	0.5	16.3	7.6
Total	9.7	0.5	0.7	0.1	7.5	1.0
Psychedelics						
15–24	8.3	0.7	0.7	0.2	8.8	2.5
25–34	14.9	1.1	0.7	0.2	4.5	1.3
35–44	12.8	1.0	0.5	0.1	3.8	1.1
45+	3.5	0.6	0.02	0.02	0.6	0.6
Total	10.6	0.6	0.5	0.1	4.9	0.7

Table 4 *(continued)*

Drug and age (years)	Proportion with a history of extramedical use		Proportion with a history of dependence		Dependence among users	
	P	*SE*	*P*	*SE*	*P*	*SE*
Heroin						
15–24	0.7	0.3	0.1	0.1	20.1	10.1
25–34	1.7	0.3	0.3	0.1	15.0	6.0
35–44	2.7	0.5	0.8	0.4	31.8	10.7
45+	0.7	0.3	0.1	0.05	10.7	7.7
Total	1.5	0.2	0.4	0.1	23.1	5.6
Inhalants						
15–24	8.1	1.0	0.6	0.3	7.9	3.8
25–34	9.9	0.8	0.1	0.1	1.5	0.7
35–44	5.7	0.7	0.1	0.1	2.6	1.4
45+	1.8	0.5	0.04	0.04	2.2	2.3
Total	6.8	0.4	0.3	0.1	3.7	1.4
Any drug group[c]						
15–24	42.8	1.8	7.4	1.1	17.3	2.3
25–34	64.7	1.7	9.5	0.9	14.7	1.2
35–44	56.4	1.6	8.5	0.9	14.9	1.5
45+	31.5	1.8	2.9	0.8	9.2	2.5
Total	51.0	1.0	7.5	0.4	14.7	0.7

Note. Weighted estimates from the National Comorbidity Survey data gathered in 1990–1992 for persons 15–54-years-old (n = 8,098). Dashes indicate data not estimated.
[a]Tobacco use estimates from the 1991 National Household Survey on Drug Use, as described in the *Assessment of Alcohol and Other Drug Use* section. n = 4,414. Dependence among users estimated by the algebraic method described in the *Analysis Procedures* section; standard errors not estimated.
[b]Anxiolytics, sedatives, and hypnotic drugs, grouped.
[c]"Any drug group" refers to the aggregate category comprising the controlled substances and inhalant drugs, but not alcohol or tobacco.

female users were somewhat more likely than male users to have developed dependence. For example, an estimated 14% of men (±0.8%) and 11.5% of women (±0.8%) reported extramedical use of at least one anxiolytic, sedative, or hypnotic drug. Among these extramedical users, an estimated 6.6% of the men (±1.0%) and 12.3% of the women (±2.2%) had developed dependence on this class of drugs (Table 5).

Discussion

Comparison of Prevalence Estimates

On the basis of general consensus, a DSM–III–R task panel on drug dependence decided to modify the Edwards–Gross alcohol dependence concept and to adopt this modification as a unified construct that would apply to all psychoactive drugs (Kosten & Kosten, 1991; Kosten, Rounsaville, Babour, Spitzer, & Williams, 1987). As a result of this development, for the first time in an epidemiologic field survey we have been able to hold constant the diagnostic criteria for drug dependence as they are applied to users of tobacco, alcohol, controlled substances, and inhalants and to reduce marked between-drug differences in diagnostic assessments for drug dependence. In doing so, we found that a substantial proportion of the 15–54-year-old population in the United States—about 1 in 13 persons or 7.5%—has been affected by dependence on controlled substances or inhalants. By comparison, almost twice as many had developed alcohol dependence, about 14%, and about three times as many, 24.1%, had developed tobacco dependence at some time in life up to the time of the survey. The extent to which the nation's health is compromised by this history of drug dependence is likely to be a topic of investigation for many years.

To place the potential health and social burdens of drug dependence in context with the burden of other psychiatric morbidity, it may be useful to

compare lifetime prevalence estimates for dependence on individual drugs with the lifetime prevalence of selected DSM–III–R anxiety and mood disorders ascertained by the CIDI method, which our research group has reported in a separate publication (Kessler et al., 1994). To illustrate, for this article we have estimated that cannabis dependence has affected 4.2% of the study population. This places the prevalence of cannabis dependence in rank between panic disorder (3.5% prevalence) and generalized anxiety disorder (5.1% prevalence) or agoraphobia without panic disorder (5.3% prevalence).

Comparatively, a history of cocaine dependence was found in 2.7% of the study population. Cocaine dependence was almost as prevalent as antisocial personality disorder (3.5% prevalence), and was about 70% more common than bipolar disorder (1.6% prevalence). Alcohol dependence (14.1%) was somewhat more common than simple phobia (11.3%) and social phobia (13.3%), whereas tobacco dependence at 24.1% was more prevalent than major depressive disorder at 17.1% (Kessler et al., 1994).

Checked against ECA estimates for lifetime prevalence of drug dependence, the NCS values generally were similar. To illustrate, ECA versus NCS estimates for cannabis disorders both were close to 4% (4.4% vs. 4.2%, respectively); for psychostimulants other than cocaine, both estimates were 1.7%; for the sedative drug group, both estimates were 1.2% (Anthony & Helzer, 1991).

One noteworthy exception involved cocaine, in that less than 1% of the ECA study population qualified for a cocaine disorder, whereas 2.7% of the NCS study population did so. In part, this difference can be attributed to a change in diagnostic criteria: DSM–III criteria used for the ECA covered cocaine abuse, but did not provide for the diagnosis of cocaine dependence (Anthony & Trinkoff, 1989). In addition, the most recent epidemic of cocaine dependence in the United States also can account for some of the observed increase.

To test whether the NCS estimates for lifetime prevalence of alcohol use and illicit drug use were consistent with those from the NHSDA conducted in 1991, we reanalyzed the NHSDA data to conform with the age and sex groups created for the NCS analyses within the age range from 15 to 54 years. This seemed to be especially necessary in light of observations about the importance of privacy and self-administration strategies in survey research about illicit drug use (e.g., see Schober et al., 1992). Nonetheless, in many instances, the NCS observed estimates were slightly higher than corresponding NHSDA estimates, particularly among older adults; in others, they were no more than slightly lower, particularly among 15–24-year-olds. However, for each comparison, the NHSDA estimate was well within the range defined by 95% CI for the corresponding NCS estimate (data not shown in a table).

There are no prior national survey estimates for tobacco dependence, but a recent population survey of young adults in the Detroit, Michigan area found that 74% of 21–30-year-olds had smoked tobacco at least once; among these smokers, 27% had developed DSM–III–R tobacco dependence (Breslau, Fenn, & Peterson, 1993). By comparison, estimates from the nationally representative NCS for roughly the same age group were not too different: Of the 25–34-year-olds, 76.4% had smoked and 34.7% had developed DSM–III–R tobacco dependence.

Comparison With Prevalence Estimates for Other Nations

To be sure, there are some countries in which the lifetime prevalence of alcohol dependence or tobacco dependence appear to equal or exceed the values observed in the NCS, most notably South Korea (e.g., see Lee et al., 1990a, 1990b). However, we are aware of no epidemiologic evidence on countries in which prevalence of dependence on controlled substances exceeds the values we found for 15–54-year-old noninstitutionalized residents of the coterminous United States (e.g., see Bland, Orn, & Newman, 1988; Canino et al., 1987; Compton et al., 1991; Hwu, Yeh, & Chang, 1989; Lee et al., 1990a; Wells, Bushnell, Hornblow, Joyce, & Oakley-Browne, 1989; Wittchen, Essau, von Zerssen, Krieg, & Zaudig, 1992).

Comparative Epidemiology of Tobacco, Alcohol, and Other Drug Dependence

Epidemiologic analyses of population data often begin with a consideration of birth year or age, sex, and race. This approach draws on a long tradition of including these variables on birth records and

Table 5
Estimated Prevalence Proportion (P) of Extramedical Use and Dependence in Total Study Population and Lifetime Dependence Among Users by Sex

	Men						Women					
	Proportion with a history of extramedical use		Proportion with a history of dependence		Dependence among male users		Proportion with a history of extramedical use		Proportion with a history of dependence		Dependence among female users	
Drug	*P*	*SE*	*P*	*SE*	*P*	*SE*	*P*	*SE*	*P*	*SE*	*P*	*SE*
Tobacco[a]	78.3	0.8	25.6	1.4	32.7	—	73.1	0.7	22.6	1.3	30.9	—
Alcohol	93.5	0.5	20.1	1.0	21.4	1.0	89.6	0.7	8.2	0.7	9.2	0.8
Cannabis	51.7	1.3	6.2	0.6	12.0	1.1	41.0	1.5	2.3	0.3	5.5	0.7
Cocaine	19.5	0.9	3.5	0.4	18.0	1.9	12.9	0.7	1.9	0.3	14.9	2.0
Stimulants	18.4	0.8	1.8	0.4	9.7	1.9	12.2	0.8	1.6	0.3	13.3	2.0
Anxiolytics, etc.[b]	14.0	0.8	1.0	0.1	6.6	1.0	11.5	0.8	1.4	0.3	12.3	2.2
Analgesics	11.6	0.7	0.8	0.2	6.7	1.6	7.9	0.5	0.7	0.1	8.6	1.4
Psychedelics	14.1	0.8	0.7	0.2	5.0	1.1	7.2	0.6	0.3	0.1	4.7	1.2
Heroin	2.2	0.2	0.5	0.2	22.3	6.5	0.9	0.2	0.2	0.1	25.2	12.9
Inhalants	9.4	0.7	0.4	0.2	4.1	1.7	4.3	0.4	0.1	0.1	2.7	2.0
Drug group[c]	55.8	1.3	9.2	0.7	16.4	1.2	46.4	1.5	5.9	0.5	12.6	1.0

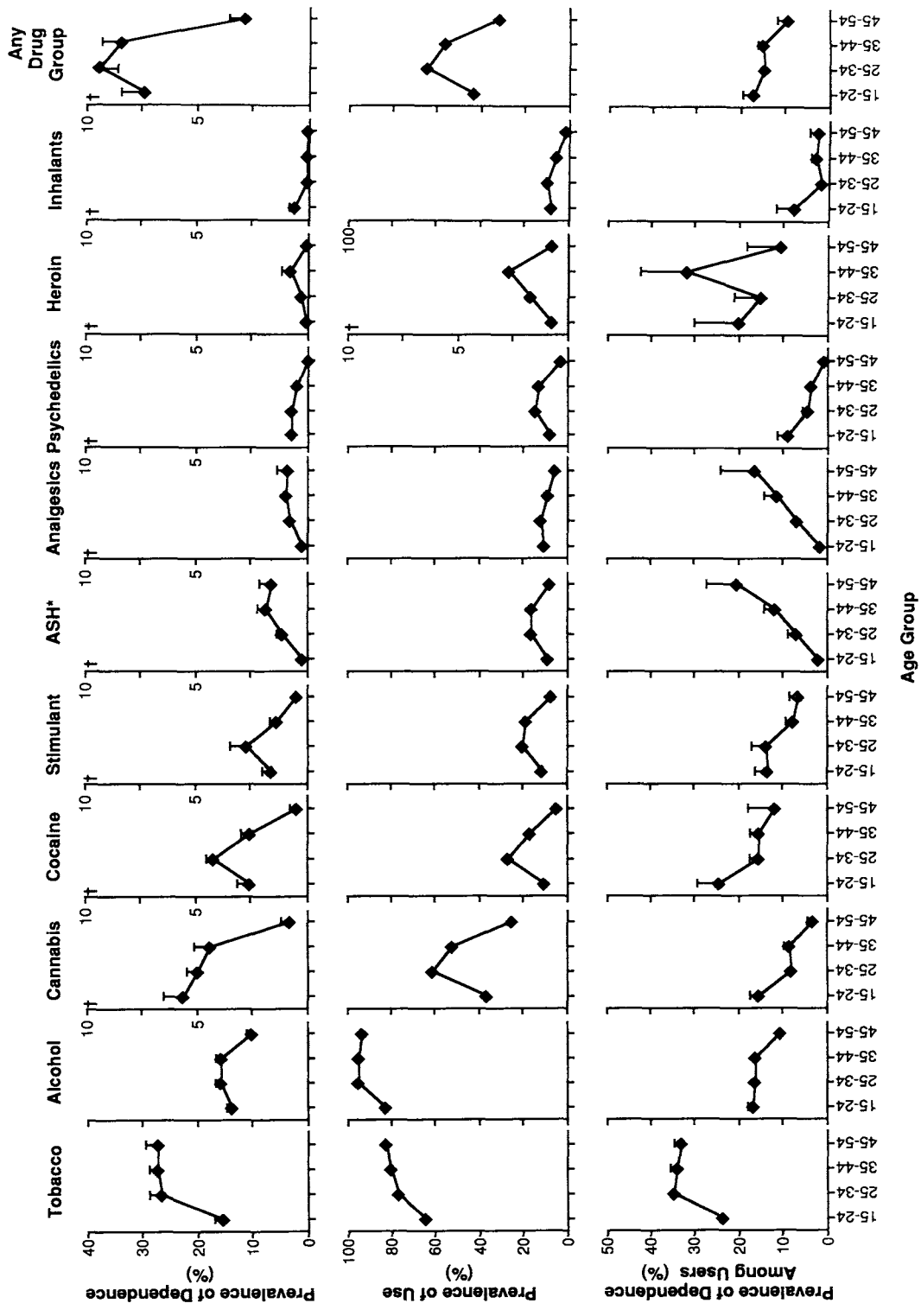
Note. Weighted estimates from the National Comorbidity Survey data gathered in 1990–1992 for persons 15–54-years-old (n = 8,098). Dashes indicate data not estimated.
[a]Tobacco use estimates from the 1991 National Household Survey on Drug Use, as described in the *Assessment of Alcohol and Other Drug Use* section. n = 4,414. Dependence among users estimated by the algebraic method described in the *Analysis Procedures* section; standard errors not estimated.
[b]Anxiolytics, sedatives, and hypnotic drugs, grouped.
[c]"Drug group" refers to the aggregate category comprising the controlled substances and inhalant drugs, but not alcohol or tobacco.

death certificates, which in many places have been the main sources of epidemiologic data. In addition, it generally is necessary to take these three inborn variables into account before assessing evidence about potentially modifiable risk factors or conditions that can be leveraged for prevention and control of disease. Moreover, birth year, sex, and race are fixed characteristics that cannot be modified by changes in conditions such as disease experience or toxic exposures.

In contrast, when we turn to the epidemiologic study of potentially modifiable conditions such as educational attainment, employment status, and access to material wealth, we face the possibility that these characteristics might influence the occurrence of disease and also might be influenced by disease. It is in this context that the limitations of cross-sectional survey data and the advantages of prospective or longitudinal data become most apparent. Reasoning along these lines, we caution against the causal interpretation of cross-sectional survey results, and we note that lifetime prevalence ratios or odds ratios from lifetime prevalence analyses typically cannot be interpreted as risk ratios or relative risk estimates (Kramer, Von Korff, & Kessler, 1980).

Even though they should not be given causal interpretation, the cross-sectional associations and odds ratios of the type estimated for this study can point out segments of the population where currently active or former cases of drug dependence are more or less likely to be found. In addition to highlighting the location of these cases within the population, cross-sectional odds ratios serve to index the strength of each observed association, whether causal or noncausal. Together with our basic prevalence estimates, the observed patterns of association (or lack thereof) represent the beginning steps for a comparative epidemiology of tobacco dependence, alcohol dependence, and dependence on controlled substances.

Scanning across odds ratio estimates from our analyses, one can find many commonalities and some noteworthy differences in the associations with dependence on tobacco, alcohol, and other drugs. Many of the observed associations are consistent with prior research, recently summarized by us and by others (e.g., Anthony, 1991;


Tobacco
Alcohol
Cannabis
Cocaine
Stimulant
ASH*
Analgesics
Psychedelics
Heroin
Inhalants
Any Drug Group
Prevalence of Dependence (%)
Prevalence of Use (%)
Prevalence of Dependence Among Users (%)
Age Group
15-24
25-34
35-44
45-54

Anthony & Helzer, 1991; Anthony & Helzer, in press; Hawkins, Catalano, & Miller, 1992; Kandel, 1991). For example, sex (being a man) had a moderate degree of association with alcohol dependence and other drug dependence but not with tobacco dependence. This finding converges with other evidence showing an increasing health burden of tobacco smoking among women, and perhaps a declining burden among men (e.g., Adams, Gfroerer, & Rouse, 1989; Johnston et al., 1992).

Another comparative difference was observed in the associations with age, especially in the contrast of 45–54-year-olds with 15–24-year-olds. The 45–54-year-olds were more likely to have a history of current or past tobacco dependence; they were less likely to have a history of dependence on alcohol or on other drugs. However, age-specific prevalence estimates for individual controlled substances prompt a slightly different conclusion about two classes of drugs that are available by prescription. Namely, compared with 15–24-year-olds, the oldest adult extramedical drug users under study were more likely to have become dependent on analgesic drugs and on anxiolytic, sedative, or hypnotic drugs, which are used widely for legitimate medical reasons. This aspect of the 45–54-year-old population's drug experience differs from its experience with alcohol, Schedule I drugs such as heroin, and inhalant drugs.

These relationships between age and drug dependence, generally consistent with prior survey findings in the United States, may be understandable as a reflection of variation in drug availability or level of drug involvement across different birth cohorts, periods, or segments of the life span (Kandel, 1991). Alternately, there are two general epidemiologic observations that may clarify underlying issues of interpretation.

The first general observation involves the force of drug-related mortality, which can have an important but nearly hidden impact on age-specific estimates from cross-sectional assessments. At the time of assessment, each age group under study consists of survivors from one or more original birth cohorts (e.g., live births in a given year, or in a given span of years). At some point, mortality associated with drug dependence starts to contribute to the loss of drug-dependent persons from each birth cohort. Although the force of drug-related mortality can be in operation for all ages of drug users, accumulated attrition due to dependence-related deaths becomes an increasingly important factor in successive years of adulthood.

In this respect, alcohol provides a good illustration. As shown in Figure 1, the lower lifetime prevalence of dependence observed among the oldest drinkers might be due partly to a premature mortality that is secondary to alcohol dependence.

There also was a sharp drop in prevalence of heroin dependence across the two oldest age groups surveyed: 2.7% for 35–44-year-olds versus 0.7% for 45–54-year-olds. Among 2,242 participants age 35–44 years in the NCS sample, there were 64 heroin users, but among 1,462 participants age 45–54 years, there were only 13 heroin users. Based on the experience of these heroin users, we were able to estimate that almost one third of the 35–44-year-old heroin users in the study popula-

Figure 1 (*opposite*). Drug-specific estimates for the lifetime prevalence of drug dependence (first row of graphs), lifetime prevalence of extramedical drug use (second row of graphs), and lifetime prevalence of drug dependence among extramedical drug users (third row of graphs), based on estimates presented in Table 4. Weighted estimates based on standardized assessment of 8,098 Americans 15–54-years-old, who were selected by probability sampling and interviewed for the National Comorbidity Survey, 1990–1992. The scale for individual graphs has been tailored for each set of estimates, with variation across rows and within rows. Error bars have been used to show the precision (standard error) of each estimate whenever possible. No error bar has been drawn when the standard error was quite small (i.e., half the height of the diamond symbol used to depict the point estimate) or in the case of tobacco dependence among users (see *Analysis Procedures* section). ASH = anxiolytic, sedative, and hypnotic drugs, grouped (e.g., secobarbital and diazepam, as well as more recently introduced compounds such as flurazepam, alprazolam, and triazolam); "Any drug group" = aggregate category comprising the controlled substances and inhalant drugs, but not alcohol or tobacco; † = change in scale.

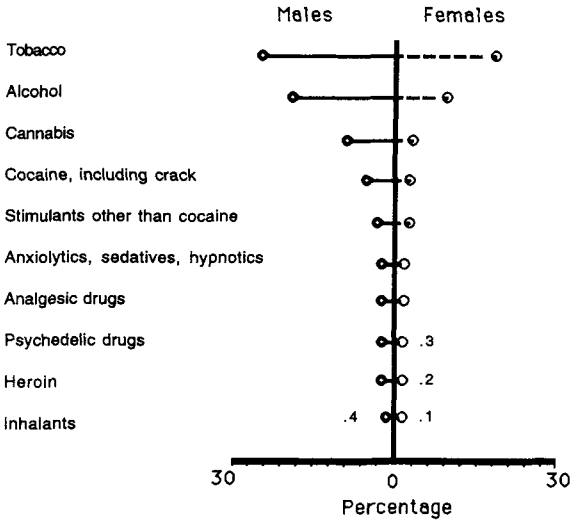


Figure 2. Estimated lifetime prevalence of drug dependence, by sex, based on estimates presented in Table 5.

tion had a history of heroin dependence, but we had too few users to produce a corresponding estimate for the 45–54-year-old heroin users. In the context of this discussion, it is informative that within this group of 13 people who were 45–54-years-old and who had used heroin at some point in their lives, there was only one user with a history of heroin dependence. We speculate that premature mortality associated with heroin dependence might account for these sharp differences in the observed heroin experience of these two older adult age groups within our study population.

The second general epidemiologic observation that merits consideration when studying age and drug dependence relates current age to the transitions from adolescence through age 34, which recent evidence pegs as the main period of risk for initiating drug use and drug dependence (e.g., see Anthony, 1991; Kandel, Murphy, & Karus, 1985). At the time of assessment in 1990–1992, the 15–24-year-olds had just started to pass through this main risk period. The importance of this fact might be seen most clearly in relation to the analgesics and the anxiolytic-sedative-hypnotic drug group. For these drugs, the proportion of extramedical users age 15–24 years who had developed a history of dependence was low, relative to the other age groups (Figure 1). This may reflect that these birth cohorts have just entered the high-risk period, and with passing time, their experience may prove to be more like the experience of their elders.

In relation to these NCS findings, two other associations deserve special comment:

African Americans and drug use. There is a widespread popular belief that African Americans are especially vulnerable to drug dependence, perhaps because of their overrepresentation in certain clinical samples. However, consistent with evidence from other recent epidemiologic surveys, the NCS estimates indicate that tobacco dependence, alcohol dependence, and dependence on other drugs are more common among White non-Hispanic Americans than among African Americans (e.g., see Anthony & Helzer, 1991; Kandel, 1991; Lillie-Blanton, Anthony, & Schuster, 1993).

Residence in a nonurban area. Alcohol and tobacco are widely available throughout the United States, but the illicit availability of controlled substances seems to vary considerably. Perhaps reflecting these different patterns of availability, residents of nonurban areas were a lower prevalence group for dependence on controlled substances but not for dependence on tobacco or alcohol (see Table 3). Analogously, the ECA survey in the Durham–Piedmont population of North Carolina found somewhat lower prevalence of drug disorders among inhabitants of rural areas compared with those living in urban areas (Anthony & Helzer, 1991).

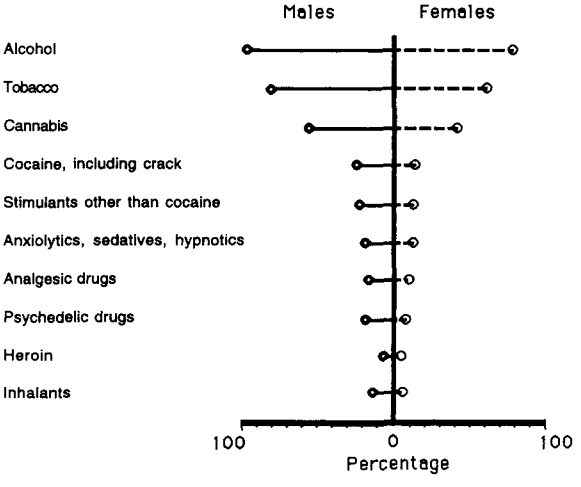


Figure 3. Estimated lifetime prevalence of extramedical drug use, by sex, based on estimates presented in Table 5.

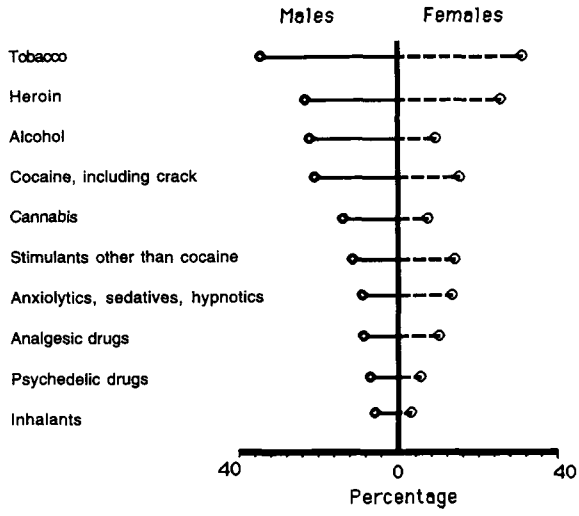


Figure 4. Estimated lifetime prevalence of drug dependence among extramedical drug users, by sex, based on estimates presented in Table 5.

Transition From Drug Use to Drug Dependence

When ECA results were published, some readers were surprised to find that many of the individuals who had used heroin or other controlled substances on more than five occasions had not developed drug dependence or other drug disorder, even though prior research on Vietnam veterans had indicated as much. For example, among heroin users in the ECA sample, only 44% had become a case of heroin dependence or heroin abuse as defined by DSM–III criteria. The corresponding estimates were close to 20% for extramedical users of cannabis, psychostimulants other than cocaine, and anxiolytics or sedative-hypnotic drugs (Anthony & Trinkoff, 1989). Similarly, Helzer (1985) and Robins (1993) have reported that most Vietnam veterans who used heroin and other opioid drugs in Vietnam did not become dependent taking these drugs while overseas.

Although not directly comparable to these ECA estimates based on the experience of individuals who had used drugs on more than five occasions, the NCS estimates also suggest that a large majority of persons who have initiated extramedical drug use have not proceeded to develop drug dependence. Even for drugs known for their dependence liability (e.g., tobacco, cocaine, heroin), the proportion of drug users who were found to have become dependent was in a range from 20–40%. Considering these prevalence estimates on the transition from drug use to drug dependence, it is noteworthy that NCS interviewers were able to develop trust and rapport sufficient to elicit reports of illegal drug-taking behavior from many participants. We speculate that many participants who acknowledge past illicit behavior also may be willing to report personal problems and other symptoms of drug dependence that they have experienced. At the same time, we acknowledge a strong possibility that some drug-dependent participants did not report on these problems with completeness or total accuracy, which would tend to attenuate the proportion of dependent persons among extramedical drug users.

On conceptual grounds, it can be argued that the transition from drug use to drug dependence in the population is determined partly by the reinforcing functions served by drug-taking and associated behaviors, with a linkage back to profiles of drug activity discovered through laboratory research (e.g., see Schuster, 1989; Thompson, 1981). In addition, this transition seems to be determined in part by other factors, some linked to the reinforcing functions of drug use, and some not so readily studied inside the laboratory (e.g., see Brady, 1989; Glantz & Pickens, 1992; Schuster, 1989). In theory, the array of these interrelated factors includes relative drug availability and opportunities for use of different drugs as well as their cost; patterns and frequencies of drug use that differ across drugs; different profiles of vulnerabilities of individuals whose extramedical use starts with one drug versus another, as well as both formal and informal social controls and sanctions against drug use or in its favor, which might be exercised either within intimate social fields such as the family or workplace or by larger units of social organization. Considered all together, the array of theoretically plausible determinants of the transition from drug use to drug dependence runs a span from the microscopic (e.g., the dopamine receptor) through the macroscopic (e.g., social norms for or against drug use; international drug-control policies).

A better understanding of these sources of variation, as well as attention to methodological features of cross-sectional survey research, would help us account for the rank ordering of individual drugs and drug groups in relation to the prevalence of extramedical drug use and in relation to the proportion of extramedical users who were found to have developed dependence. It is of consider-

able interest that the rank ordering by prevalence of extramedical drug use was quite similar for both men and women, differing only by the higher prevalence of psychedelic drug use among men.

The rank ordering in relation to transitions from drug use to drug dependence was not the same as that seen for prevalence of extramedical drug use. In addition, the ranking of drugs in relation to the use-to-dependence transition showed some variation across male and female drug users and across age groups. For both men and women, and for all but the oldest age group of drug users, tobacco and heroin were top ranked; psychedelic drugs and inhalants were at the bottom. There were male–female differences in lifetime prevalence of dependence among extramedical drug users only for alcohol and cannabis. An estimated 21.4% of the male alcohol drinkers had developed dependence, compared with an estimated 9.2% of female drinkers. Corresponding male and female estimates for cannabis were 12% and 5.5%, respectively. It is noteworthy that alcohol and cannabis had higher rank among men, whereas the anxiolytics–sedatives–hypnotic drug group was higher ranked for women (Table 5).

Notwithstanding these general observations, some attention should be given to the fact that 15–24-year-old drug users had a comparatively high lifetime prevalence of drug dependence in connection with cocaine and alcohol and with Schedule I drugs such as marijuana. To illustrate, for cocaine, almost 25% of the 15–24-year-old users had developed dependence. By comparison, only 15% of the 25–44-year-old cocaine users had developed dependence. To the extent that the 15–24-year-olds have many remaining years at risk, their already high value may become even higher, but for a possibly compensating influence. Namely, it has been observed that early onset illicit drug users (e.g., those who initiate illicit drug use before age 17) seem to be at increased risk for developing drug problems compared with drug users with a later start (e.g., after age 17), even when statistical adjustments are made for differences in duration of drug use (e.g., see Anthony & Petronis, 1993; Robins & Przybeck, 1985). It follows that the cumulative occurrence of drug dependence at first might be especially high among 15–24-year-old drug users, but then might decline as the lower risk experience of later onset drug users is added to this birth cohort's total drug experience. This is an empirical question that deserves continued study, including future analyses of the NCS data on the experience of individual birth cohorts born since 1935.

Future Directions for Research and Other Implications

Future directions for research on these topics can be guided by careful consideration of the present study's deficiencies. Foremost among these limitations is a cross-sectional study design that has placed heavy reliance on retrospective self-report methods, constraining scientific inference about risk and risk factors in relation to drug dependence. Given unbounded resources, we would have liked to make a prospective investigation of each drug's users, starting well before drug use had begun, with periodic observations sustained through periods of risk for drug dependence and other drug-related hazards, including the risk of drug-induced death. Instead, for cost containment, as in the ECA program, the annual NHSDA, and other large-scale epidemiologic surveys, we have sampled the population's experience cross-sectionally and have measured retrospectively. This approach leaves out the experiences of people who have died, as well as those who failed to recall and report their drug involvement with accuracy. Thus, it is useful to remember that on one side lifetime prevalence estimates based on self-reports are hemmed in by the seriousness of death, on the other side by long-forgotten or casual drug involvement that doesn't seem worth mentioning at the time of assessment. To the extent that some conditions may be associated with considerable risk of death (e.g., heroin dependence in the United States), this commonly used study design actually can yield an undercount of morbidity: Many seriously affected persons have died. To the extent that other conditions may be regarded as inconsequential and pointless to mention (e.g., taking a puff on someone else's marijuana cigarette without inhaling), the same approach can yield an overcount of morbidity: Many mildly affected persons are neglected.

As noted previously in this section, cross-sectional survey designs also can lead to misinterpreted time relationships. For example, in this study, it appears that low educational achievement might signal an increased risk of alcohol depen-

dence. In fact, the cross-sectional evidence of this study does not clarify whether alcohol dependence is a risk factor for low educational achievement, whether low education is a risk factor for alcohol dependence, whether the relationship is reciprocal, or whether unmeasured antecedents might explain the observed associations between education and alcohol dependence. In this instance, we are fortunate to have recently published evidence from a prospective study, which found excess risk of alcohol disorders among adults who had not received high school or college diplomas compared with college graduates (Crum, Bucholz, Helzer, & Anthony, 1992; Crum, Helzer, & Anthony, 1993). Of course, whether cross-sectional or prospective, the evidence from a single observational study does not always lead to clear inferences about cause and effect; our study is no exception. As in experimental research, systematic replication is essential, and ultimately causal inferences must be based on judgments about the available evidence.

Limitations of more secondary importance include a restriction of the sampling frame to noninstitutionalized residents who could be sampled from identified dwelling units. Anthony and Trinkoff (1989) and Anthony and Helzer (1991) have discussed and demonstrated how overall prevalence rates for drug dependence and related conditions change very little when institutional residents (and by extension, the homeless) are included within the survey sampling frame. However, it should be acknowledged that this overall generalization might not hold for population subgroups with especially high rates of drug-related incarceration (e.g., young men of African-American heritage).

Current interest in hair analysis and other bioassays for illicit drug use raises a legitimate question about interview assessments of drug dependence (e.g., see Kidwell, 1992). Defined in terms of DSM–III–R diagnostic criteria and case definitions, drug dependence is a psychiatric disturbance for which recent drug use is but one indicator. Except in unusual circumstances, these diagnostic criteria for drug dependence can be assessed only by means of interviews or examinations, either with designated respondents themselves or with informants for these respondents. Given the size of the NCS sample and restricted resources, it was not possible to interview informants.

Against this background of study limitations, it is important to focus on the two epidemiologic questions for which this type of cross-sectional field study is indispensable: (a) In the population, what proportion of persons has been affected by drug dependence? and (b) Comparing subgroups, where in the population are cases of drug dependence more likely to be found? Although the answers to these questions do not constitute definitive evidence with regard to cause and effect relationships or mechanisms of action, these answers have an important public health value. As mentioned in our introduction, these answers can be of use to members of the scientific community and can serve to guide program and policy decisions.

In this respect, the most important implications of this study's results may concern its quantitative findings about the prevalence and location of drug dependence within the population, and the transition from drug use to drug dependence, now assessed with epidemiologic estimates on the basis of an NCS sample designed to generalize to a large segment of the American population. The NCS draws attention to the relative frequency of dependence on tobacco, alcohol, controlled substances and inhalants, disclosing that many more Americans age 15–54 have been affected by drug dependence than by other psychiatric disturbances now accorded a higher priority in mental health service delivery systems, prevention, and government-sponsored research programs. NCS findings on prevalence correlates add to a growing body of evidence that African Americans do not seem to be more vulnerable to drug dependence by virtue of their race, and these findings also point toward some population segments such as homemakers, in which excess drug dependence has been suspected but never demonstrated clearly. Finally, the NCS results highlight an increasingly well-documented observation that many drug users, perhaps a vast majority, do not seem to make a transition to drug dependence. For them, instead, drug use lacks the major complications associated with clinically defined syndromes of drug dependence. In a time of increasing concern about government expenditures for health and health care reform, the distinction between drug use and drug dependence deserves greater consideration, with commensurate allocation of resources in the direction of drug dependence syndromes that affect public health and society all too commonly.

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