

# The National Epidemiologic Survey on Alcohol and Related Conditions (NESARC) Waves 1 and 2: review and summary of findings

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## Abstract

**Purpose** The NESARC, a “third-generation” psychiatric epidemiologic survey that integrated detailed measures of alcohol and drug use and problems has been the data source for over >850 publications. A comprehensive review of NESARC findings and their implications is lacking.

**Method** NESARC was a survey of 43,093 participants that covered alcohol, drug and psychiatric disorders, risk factors, and consequences. Wave 1 of the NESARC was conducted in 2001–2002. Three years later, Wave 2 follow-up re-interviews were conducted with 34,653 of the original participants. Scopus and Pubmed were used to search for NESARC papers, which were sorted into topic areas and summarized.

**Result** The most common disorders were alcohol and posttraumatic stress disorders, and major depression. Females had more internalizing disorders and males had more externalizing disorders, although the preponderance of males with alcohol disorders (the “gender gap”) was less

pronounced than it was in previous decades. A race/ethnic “paradox” (lower risk among disadvantaged minorities than whites) remains unexplained. Younger participants had higher risk for substance and personality disorders, but not unipolar depressive or anxiety disorders. Psychiatric comorbidity was extensive and often formed latent trans-diagnostic domains. Since 1991–1992, risk for marijuana and prescription drug disorders increased, while smoking decreased, although smoking decreases were less pronounced among those with comorbidity. A nexus of comorbidity, social support, and stress predicted transitions in diagnostic status between Waves 1 and 2. Childhood maltreatment predicted psychopathology. Alcohol and drug use disorders were seldom treated; attitudinal barriers (little perceived need, perceived alcoholism stigma, pessimism about efficacy) were more important in predicting non-treatment than financial barriers. **Conclusions** Understanding comorbidity and the effects of early stressors will require research incorporating biologic components, e.g., genetic variants and brain imaging. The lack of treatment for alcohol and drug disorders, predicted by attitudinal rather than financial variables, suggests an urgent need for public and professional education to reduce the stigma associated with these disorders and increase knowledge of treatment options.

The views and opinions expressed in this report are those of the authors and should not be construed to represent the views of any of the sponsoring organizations or agencies or the US government.

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## Introduction

In 2001–2002, Wave 1 of the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC) was conducted to provide information from 43,093 American

adults on the common mental substance and psychiatric disorders as defined in DSM-IV [1]. In 2004–2005, a Wave 2 re-interview was conducted with 34,093 NESARC participants, covering the onset and persistence of disorders first assessed in 2001–2002, selected new disorders, and a wide set of risk factors. While NESARC was unprecedented in size, scope, its longitudinal component, and number of publications, it is best understood within the larger framework of American psychiatric and substance use surveys over several decades.

Psychiatric epidemiologic surveys cluster into three “generations” [2, 3]. “First-generation” studies (pre-World War II) ascertained the prevalence of mental disorders from professional informants (physician, agencies). Because this methodology was likely to miss untreated cases, “second-generation” post-World War II community surveys used interviewers to examine survey participants. The two best-known US second-generation studies were the Midtown Manhattan [4] and Stirling County studies [5]. Lay interviewers collected data (including depression and anxiety symptom scales) that psychiatrists evaluated for caseness or impairment severity. These surveys included a few questions on drinking or drug use, but their focus was on non-substance psychopathology.

In the 1960s, in a separate line of research, US national alcohol surveys began at the Alcohol Research Group [6]. These provided prevalence of drinking, heavy/binge drinking, and drinking problems, but did not assess substance or psychiatric disorders. National drug use surveys, now known as the National Surveys on Drug Abuse and Health [7], began with the 1971 National Household Survey on Drugs and Health [8]. The drug surveys mainly focus on the prevalence of use, with problems or disorders a secondary focus.

The third generation of psychiatric epidemiologic surveys [2] involved assessments of mental and substance disorders according to specified criteria defined by the Diagnostic and Statistical Manual (DSM), starting with the 3rd edition (DSM-III; [9]). In these, fully structured diagnostic interviews covering the symptoms and criteria were administered by lay interviewers. The first was the five-site 1979–1981 Epidemiologic Catchment Area (ECA) survey [10–12]. The ECA indicated surprisingly high comorbidity of alcohol, drug, and psychiatric disorders [13]. To investigate comorbidity further, the 1991–1992 National Comorbidity Survey (NCS; [14]) ascertained DSM-III-Revised (DSM-III-R; [15]) diagnoses among 8098 individuals and risk factors among 5877 of these. The NCS also showed high comorbidity [14]. The 2001–2003 National Comorbidity Survey-Replication (NCS-R; [16]) of 9282 respondents was designed in part to examine DSM-IV disorders [16].

The ECA, NCS, and NCS-R were major studies generating many important findings. However, they did not

include detailed alcohol and drug measures, and sample sizes limited precise estimates of specific alcohol, drug or psychiatric disorders, of comorbidity between specific disorders, or fine-grained examination of specific risk factors. The NCS-R interview also had errors in diagnosing alcohol and drug dependence [17, 18], limiting their assessment [19, 20].

These issues led NIAAA to investigate the epidemiology of alcohol and drug disorders and related conditions. The NIAAA 1991–1992 National Longitudinal Alcohol Epidemiologic Survey (NLAES [21–23]) of 42,862 adults covered alcohol and drug use in detail, and DSM-IV-defined alcohol, drug, and depressive disorders. NLAES represented a significant advance in sample size and its measure, the Alcohol Use Disorders and Associated Disabilities Interview Schedule (AUDADIS; [24]), which covered alcohol and drug-related conditions and provided detailed symptom- and criterion-based assessment of DSM-IV-defined disorders. NLAES provided precise estimates of alcohol and drug disorder prevalence and correlates [21, 22], including comorbidity with depressive disorders [23, 25]. NLAES also provided the first national evidence that early onset of drinking or drug use was a strong risk factor for later abuse or dependence [26, 27]. NLAES also represented important methodological developments in the measurement of alcohol consumption [28]. However, coverage of other psychiatric disorders, longitudinal data, and updated findings at the beginning of the twenty-first century were needed. These needs led to the NESARC.

NESARC covered alcohol and drug use, alcohol, drug and psychiatric disorders, risk factors and consequences. Wave 1 was conducted in 2001–2002. Follow-up Wave 2 interviews conducted 3 years later provided the first nationally representative information on incidence and persistence of disorders, prevalence of selected new disorders, and risk factors. NESARC data generated many studies [29]. A comprehensive review of NESARC studies is lacking [29]. Therefore, we searched Pubmed and Scopus with the terms, “National Epidemiologic Survey on Alcohol and Related Conditions”; “NESARC”; “Nationally Representative Sample”; Alcohol; “United States”; “43,093”; and “34,653”. This revealed >850 papers, with new ones constantly forthcoming. Using Scopus to determine citations, 6 NESARC papers were cited >600 times; 7 301–600 times; 38 101–300 times; and 308 11–100 times. Thus, NESARC is a major, influential source of information, and findings on alcohol, drug, and psychiatric disorders warrant a review of its findings.

Below, we describe NESARC methods, summarize prevalence and socio-demographic characteristics associated with disorders, and review selected research areas, including psychiatric comorbidity, time trends, disorder

course/transitions examined prospectively, adverse childhood experiences, DSM-5, and treatment utilization.

## NESARC methodology

Wave 1 was a nationally representative face-to-face survey of respondents  $\geq 18$  years [30]. The target population was US civilian non-institutionalized individuals in households and selected group quarters. Blacks, Hispanics, and adults aged 18–24 years were oversampled. The sample was weighted to adjust for probabilities of selection, nonresponse, and oversampling. Once weighted, data were adjusted to represent the US population based on the 2000 Decennial Census. The response rate was 81.0 %. NESARC incorporated NLAES methodology innovations: involvement of the US Census for sample design and field work, a sample of  $>40,000$  from counties selected from the American Community Survey across the 50 states, oversampling for disadvantaged minority groups, measurement of key socio-demographic characteristics using census-defined variables, and validity checking of interview responses by call-backs to randomly selected participants to re-ask subsets of interview questions.

Wave 2 [31] involved re-interviews of 34,653 Wave 1 participants (mean Wave 1–Wave 2 interval, 36.6 months), a response rate of 86.7 % (cumulative Wave 2 response rate, 70.2 %). Wave 2 data were weighted to reflect design characteristics. Adjustment for nonresponse across socio-demographic characteristics and Wave 1 substance or psychiatric disorders was performed at the household and person levels. Weighted data were adjusted to represent the US civilian population based on the 2000 Decennial Census.

## Overview of NESARC variables

Waves 1 and 2 included drinking quantity and frequency (overall and by beverage type); frequency of drug use by type; diagnoses and symptom data for psychiatric and substance use disorders; medical conditions; treatment utilization; functional impairment; socioeconomic information; family history of substance and psychiatric disorders; and past-year stressful life events. Wave 2 covered 3-year incidence, remission and chronicity of substance use, and the disorders assessed at Wave 1; three personality disorders not assessed at Wave 1; attention deficit hyperactivity disorder (ADHD) and posttraumatic stress disorder (PTSD); and scales measuring childhood maltreatment (abuse, neglect); other childhood adversities (parental violence, divorce); perceived discrimination due to gender, race/ethnicity, physical disability, religion, weight, and

sexual orientation; immigration/acclimation; religiosity; social support, and perceived alcoholism stigma (e.g., “Most employers will hire a former alcoholic if he or she is qualified for the job” [32, 33]). These scales were based on previously tested measures, as detailed in Ruan et al. [32].

## Measures

The Alcohol Use Disorders and Associated Disabilities Interview Schedule (AUDADIS; [24]) was the diagnostic instrument used in NLAES. AUDADIS is a fully structured interview administered by lay interviewers. Measurement innovations of AUDADIS included careful disaggregation of the complex behaviors and symptoms defining alcohol and drug abuse and dependence criteria in DSM-III, DSM-III-R, DSM-IV, and ICD-10 into separate items, facilitating analyses of patterns and structure. Because SUDs required clustering of criteria within a 12-month period, AUDADIS differentiated between criteria occurring in the last 12 months, and prior to the last 12 months. Multiple criteria occurring during the last 12 months were automatically identified as clustered. For criteria occurring prior to the last 12 months, a clustering question ensured that a syndrome occurred. AUDADIS modules covering affective disorders included items on the temporal relationship of the syndromes to use of alcohol or drugs, and to medical illnesses. Thus, these relationships were not determined by respondent judgment, but rather by temporal co-occurrence (or lack thereof). The AUDADIS also covered treatment utilization for alcohol problems with a detailed list of general and specialty treatment sources for alcohol use disorders. A family history section covered readily observable alcohol problems in close and more distant relatives.

In NESARC, the AUDADIS-IV [34, 35] was used, a measure that incorporated the measurement innovations in the AUDADIS and built on them further. In Wave 1, AUDADIS-IV ascertained past-year, prior-to-past-year, and lifetime alcohol and drug use, and DSM-IV diagnoses of Axis I substance, mood and anxiety disorders. In Wave 2, timeframes for disorders initially assessed at Wave 1 were past year and prior to past year, but since the Wave 1 interview. Newly assessed Axis I disorders included ADHD and PTSD. Innovations in AUDADIS-IV included assessment of persistence and/or relapse/remission at Wave 2; inclusion of all DSM-IV lifetime personality disorders (seven at Wave 1, three at Wave 2); assessment of treatment utilization for drug disorders; perceived alcoholism stigma; and adaptation for national survey use of measures of perceived discrimination based on several statuses (gender, race/ethnicity/weight/disability/religion/sexual orientation); early and recent life stressors; social support, social networks, and ethnic identification.

## Major findings

### Reliability; validity

In AUDADIS-IV test–retest reliability studies, a different, blinded interviewer conducts the re-interview, rigorously testing replicability of AUDADIS-IV measures. In the US general population [24, 32, 35], treatment [36, 37] and international samples [38, 39] reliability was good–excellent for DSM-IV alcohol, drug, nicotine, and personality disorders ( $k = 0.60–0.91$ ); fair–excellent for DSM-IV mood and anxiety disorders ( $k = 0.40–0.77$ ); and good–excellent for PTSD and ADHD ( $k = 0.63–0.77$ ). Reliability of dimensional disorder measures (criteria counts) exceeded reliability of diagnoses [35, 36]. Reliability of substance use variables was good–excellent for alcohol ( $k = 0.62–0.99$ ) [24, 35], fair–excellent for drugs [24, 36], and good–excellent for tobacco ( $k = 0.60–0.92$  [35]). Reliability of family history (FH; parents/siblings) was good–excellent (alcohol;  $k = 0.65–1.00$  [40]; major depression;  $k = 0.72–0.87$  [35]). Reliabilities of perceived discrimination scales due to race/ethnicity, gender, sexual orientation, religion, disability, and weight were fair–excellent ( $k = 0.50–0.82$  [32]). Scales with excellent reliability ( $\geq 0.75$ ) included: acculturation; race/ethnic identity; childhood abuse/neglect; intimate partner violence; perceived stress; stressful life events; perceived alcoholism stigma. Scales/items with very good–excellent reliability ( $\geq 0.60$ ) included: other adverse childhood experiences (e.g., parental divorce); social support; social networks; sexual orientation/attraction/behavior. Validity of AUDADIS-IV diagnoses was illustrated by high correspondence to clinician re-evaluations [37, 41] and strong association with functional impairment.

### Prevalence and demographic risk factors

Tables 1, 2, 3, and 4 present the prevalence of disorders for the full sample and by demographic characteristics. Table 1 presents alcohol, drug, and nicotine use disorders (AUD; DUD; NUD [42–44], Table 2 presents mood disorders [45–47], Table 3 presents anxiety disorders [48–52], and Table 4 presents personality disorders [53–56].

### Twelve-month prevalence of psychiatric and substance use disorders

The prevalence of AUD (abuse or dependence) was 8.5 %, higher than DUD (2.0 %); the prevalence of nicotine dependence was 12.8 %. Major depressive disorder was more prevalent (5.3 %) than other affective disorders. The prevalence of anxiety disorders varied from 0.1 % (agoraphobia) to 7.1 % (specific phobia). Thus, many disorders were common.

## Lifetime prevalence of psychiatric and substance use disorders

The prevalence of AUD (30.3 %) was higher than DUD (10.3 %); the prevalence of nicotine dependence was 17.7 %. The greater ratio of current to lifetime cases for nicotine than other substance disorders suggests less remission for nicotine dependence. Major depression was more prevalent (13.2 %) than other affective disorders. Lifetime prevalence of anxiety disorders ranged from 0.3 % (agoraphobia) to 9.4 % and 9.5 % for specific phobia and PTSD, respectively. The prevalence of DSM-IV personality disorders (PD) also ranged widely, from dependent (0.5 %) to obsessive–compulsive (7.9 %).

### Gender

Antisocial and substance disorders were more common in males [42–44, 53], as were narcissistic [55] and schizotypal PDs [56]. Most mood and anxiety disorders were more common in females [45–52], as were avoidant, dependent, and paranoid PDs; other PDs did not differ by gender [53]. Sixty-seven NESARC papers focused on gender differences, a rich literature, including symptoms [57–60], likelihood of disorder [61–63], risk factors [64–70], and course [71]. Some studies indicated a narrowing of the male preponderance of males with alcohol disorders (the “gender gap”), speculatively explained by increasingly permissive drinking norms for women [72]. However, few studies examined mechanisms through which men and women continue to differ in the prevalence and presentation of disorders, an important area of future research [73].

### Race/ethnicity

The prevalence of alcohol and drug disorders was lower in blacks, Asians, and Hispanics than whites, but higher than whites in Native Americans [42, 43], similar to the distributions of mood and most anxiety disorders [45, 48–51]. Heterogeneity within race/ethnic groups was found for blacks [74], Hispanics [75, 76], and Asians [77]. Sixty-eight NESARC papers focused on race/ethnic differences in physical and mental health. While blacks and Hispanics are more exposed to psychosocial stress than whites, the prevalence of psychiatric disorders in these minority groups is paradoxically lower than whites [78–81]. Among immigrants, more years in the USA diminished the protective effects of minority group status, suggesting that acculturation was a risk factor [82, 83]. Consistent with this, among Hispanics, greater acculturation was associated with increased risk of disorders [79, 84], while stronger ethnic identification was protective [85]. Perceived

**Table 1** Prevalences of 12-month and lifetime DSM-IV substance use disorders by socio-demographic characteristics

Characteristic	Prevalence (%)—12-month/lifetime							
	Alcohol use disorder	Alcohol abuse	Alcohol dependence	Drug use disorder	Drug abuse	Drug dependence	Any substance disorder	Nicotine dependence
Total	8.5/30.3	4.7/17.8	3.8/12.5	2.0/10.3	1.4/7.7	0.6/2.6	9.4/32.3	12.8/17.7
Sex								
Male	12.4/42.0	6.9/24.6	5.4/17.4	2.8/13.8	2.0/10.6	0.9/3.3	13.5/44.1	14.2/20.0
Female	4.9/19.5	2.6/11.5	2.3/8.0	1.2/7.1	0.8/5.2	0.4/2.0	5.6/21.5	11.5/15.6
Race-ethnicity								
White	8.9/34.1	5.1/20.3	3.8/13.8	1.9/11.3	1.4/8.6	0.6/2.7	9.8/36.2	14.3/20.1
Black	6.9/20.6	3.3/12.2	3.6/8.4	2.4/8.7	1.6/6.4	0.8/2.4	8.1/23.1	10.4/13.1
Native American	12.1/43.0	5.8/22.9	6.4/20.1	4.9/18.4	2.3/11.6	2.6/6.9	13.5/45.1	23.2/30.3
Asian	4.5/11.6	2.1/5.6	2.4/6.0	1.4/3.8	1.0/2.9	0.4/1.0	5.3/12.8	06.4/08.1
Hispanic	7.9/21.0	4.0/11.5	4.0/9.5	1.7/7.2	1.1/5.1	0.7/2.1	8.6/22.9	06.3/08.7
Age								
18–29	16.2/30.1	7.0/12.8	9.2/17.3	5.3/14.2	3.6/10.1	1.6/4.1	18.2/33.6	16.5/19.3
30–44	9.7/36.7	6.0/21.4	3.8/15.4	1.9/14.3	1.4/10.8	0.6/3.5	10.7/39.0	14.9/19.7
45–64	5.4/31.4	3.5/20.4	1.9/11.0	0.8/8.8	0.5/6.9	0.3/1.9	5.9/33.2	12.6/19.4
65+	1.5/16.1	1.2/12.7	0.2/3.4	0.2/0.6	0.1/0.5	0.1/0.2	1.6/16.3	04.0/08.7
Marital status								
Married/cohabiting	6.1/30.4	4.0/19.5	2.1/10.9	1.0/9.2	0.7/7.1	0.3/2.1	6.7/32.3	11.1/16.7
Widowed/separated/divorced	8.1/28.8	4.4/16.5	3.7/12.3	1.7/9.8	1.0/7.1	0.7/2.8	8.8/30.4	15.7/21.1
Never married	15.9/31.2	6.9/14.0	9.0/17.2	5.2/14.1	3.6/10.2	1.6/4.0	17.7/34.1	15.2/17.9
Education								
Less than high school	7.0/23.7	3.1/13.5	4.0/10.2	2.3/8.8	1.3/6.0	1.1/2.8	8.1/26.0	15.2/19.2
High school	8.3/28.2	4.5/16.3	3.7/11.9	2.4/10.3	1.7/7.7	0.7/2.6	9.4/30.4	15.3/19.6
Some college or higher	9.0/33.2	5.2/19.8	3.8/13.4	1.7/10.8	1.2/8.3	0.5/2.5	9.7/35.2	10.7/16.3
Personal income								
\$0–19,999	7.6/23.9	3.2/12.6	4.5/11.3	2.8/9.8	1.8/6.8	1.0/3.0	8.9/26.3	14.2/18.1
\$20,000–34,999	9.5/32.3	5.5/18.6	4.0/13.8	1.9/10.5	1.3/8.1	0.5/2.5	10.2/34.0	13.2/18.7
\$35,000–69,999	9.0/37.8	6.2/23.7	2.9/14.1	1.0/11.0	0.8/8.8	0.2/2.2	9.5/39.6	11.1/17.1
\$70,000+	8.8/41.4	6.6/30.0	2.2/11.4	0.7/11.1	0.6/9.4	0.1/1.7	9.2/43.5	08.0/14.2
Urbanicity								
Urban	8.4/29.6	4.6/17.4	3.8/12.2	2.0/10.4	1.4/7.8	0.6/2.6	9.3/31.7	12.0/16.8
Rural	8.8/33.3	4.8/19.4	4.0/13.8	1.9/10.2	1.2/7.7	0.7/2.5	9.5/35.2	16.0/21.4

Table 1 continued

Characteristic	Prevalence (%)—12-month/lifetime							
	Alcohol use disorder	Alcohol abuse	Alcohol dependence	Drug use disorder	Drug abuse	Drug dependence	Any substance disorder	Nicotine dependence
Region								
Northeast	7.8/27.1	4.3/16.6	3.5/10.6	2.1/9.2	1.5/6.9	0.6/2.2	8.8/29.0	11.5/16.3
Midwest	10.6/35.3	5.9/20.7	4.6/15.0	2.0/10.8	1.3/8.2	0.7/2.6	11.4/37.6	15.7/21.5
South	7.3/27.0	4.2/16.7	3.1/10.3	1.5/8.7	0.9/6.8	0.5/1.9	8.0/28.9	13.0/17.3
West	8.8/32.6	4.5/17.6	4.3/15.1	2.7/13.5	2.0/9.5	0.7/4.0	10.1/35.3	10.5/15.7

All substance use disorders were assessed at Wave 1

discrimination was associated with increased prevalence of disorders [75], but effective coping mechanisms (e.g., discussing the discrimination with others) were protective [86]. Nevertheless, the paradoxically lower prevalence among race/ethnic minorities remains to be better explained [87].

### Age

The prevalence of alcohol and drug use disorders was higher in younger than older participants [42, 43]. Given that development of different brain structures and processes does not end in adolescence and can continue into adulthood [88–91], the high prevalence of alcohol and drug disorders in younger adults may reflect late maturation of neurodevelopmental processes involving executive functioning. Completion of neurodevelopment in the mid-20s may also account for the “maturing out” often seen in early-adult alcohol and/or drug disorders [92], while other influences (e.g., neuroadaptation to substance use leading to negative reinforcement, genetic, environmental factors) may lead to the persistence of such disorders into and through adulthood. These explanations for age differences require longitudinal epidemiologic testing of phenotypes relative to genetic variants and brain functioning.

Bipolar mood disorders followed a similar age pattern, as did personality disorders. In contrast, major depression, dysthymia, panic disorder, agoraphobia, and PTSD differed little in prevalence between young and middle-aged adults. The prevalence of specific phobia and generalized anxiety disorder did not vary by age. The differences in age patterns for substance vs. depression and anxiety disorders suggest different etiologic mechanisms for each type of disorder.

### Marital status

Most disorders [42–52], including personality disorders [53], were more common in unmarried (divorced, widowed, and never married) than married participants. Only social anxiety disorder and agoraphobia showed little variation by marital status [53]. However, the causal direction between unmarried status and psychiatric disorder is unclear. Dysfunction accompanying disorders can impair ability to establish or maintain a marriage, e.g., a study showed that Wave 1 alcohol disorders predicted marital dissolution at Wave 2 [93]. However, lack of social/emotional marital support may also increase risk for disorders, e.g., a study showing that unexpected death of a loved one at Wave 1 increased risk for Wave 2 disorders [94]. Thus, both causal directions are plausible. This area merits further investigation with additional disorders.

**Table 2** Prevalences of 12-month and lifetime DSM-IV mood disorders by socio-demographic characteristics

Characteristic	Prevalence (%)—12-month/lifetime			
	Major depressive disorder	Dysthymia	Bipolar I	Bipolar II
Total	5.3/13.2	1.4/3.2	2.0/3.3	0.8/1.1
Sex				
Male	3.6/9.0	0.9/2.1	1.8/3.2	0.7/1.0
Female	6.9/17.1	1.8/4.2	2.2/3.4	0.9/1.3
Race–ethnicity				
White	5.5/14.6	1.4/3.5	2.1/3.3	0.9/1.1
Black	4.5/8.9	1.2/2.4	2.1/3.5	1.0/1.3
Native American	8.9/19.2	2.1/5.2	3.3/6.2	1.6/2.1
Asian	4.1/8.8	1.2/2.1	1.0/2.0	0.3/0.5
Hispanic	4.3/9.6	1.2/2.2	1.9/3.1	0.6/0.9
Age				
18–29	6.4/12.0	1.1/2.1	3.4/5.0	1.9/2.2
30–44	5.5/14.0	1.4/3.3	2.2/3.7	0.8/1.3
45–64	5.6/15.9	1.6/4.4	1.8/3.0	0.4/0.7
65+	2.7/8.2	1.1/2.3	0.4/0.9	0.1/0.2
Marital status				
Married/cohabiting	4.2/12.1	1.0/2.7	1.5/2.7	0.5/0.8
Widowed/separated/divorced	7.9/18.8	2.6/5.8	2.5/3.8	0.8/1.2
Never married	6.3/12.0	1.3/2.6	3.2/4.7	1.7/2.0
Education				
Less than high school	5.7/11.3	1.8/3.5	2.6/4.0	0.9/1.2
High school	5.0/12.1	1.5/3.1	2.1/3.5	0.9/1.1
Some college or higher	5.3/14.4	1.2/3.2	1.8/3.0	0.8/1.1
Personal income				
\$0–19,999	6.5/14.0	1.9/3.8	2.8/4.4	1.0/1.3
\$20,000–34,999	4.8/13.2	1.3/3.0	1.8/3.0	0.8/1.2
\$35,000–69,999	3.9/12.3	0.6/2.5	1.1/2.1	0.5/0.9
\$70,000+	3.4/11.3	0.8/2.2	0.6/1.3	0.4/0.6
Urbanicity				
Urban	5.2/13.0	1.3/3.1	1.9/3.3	0.8/1.1
Rural	5.7/14.2	1.6/3.5	2.4/3.6	0.9/1.1
Region				
Northeast	5.1/12.3	1.5/3.5	1.9/3.3	0.6/0.9
Midwest	5.5/14.1	1.4/3.4	2.4/3.4	1.0/1.3
South	5.3/12.5	1.3/2.7	1.8/2.9	0.7/1.0
West	5.2/14.3	1.4/3.5	2.1/3.9	0.9/1.2

All mood disorders were assessed at Wave 1. Bipolar II prevalences were generated specifically for this paper

## Education

Prevalence of alcohol, drug, mood, and anxiety disorders varied little by educational status [42, 43], although the prevalence of drug dependence was higher among those who had not finished high school [43]. Personality disorders were more likely among those with lower education [53, 54], suggesting that long-term personality dysfunction

in late adolescence/early adulthood may impair their ability to complete education.

## Income

The prevalence of alcohol abuse was higher among those with higher incomes, while the prevalence of dependence was higher among those with lower incomes. The

**Table 3** Prevalences of 12-month and lifetime DSM-IV anxiety disorders by socio-demographic characteristics

Characteristic	Prevalence (%)—12-month/lifetime						
	Panic disorder	Agoraphobia	Social anxiety disorder	Specific phobia	Generalized anxiety disorder	Posttraumatic stress disorder	Any anxiety disorder (not including PTSD)
Total	2.1/5.1	0.1/0.2	2.8/5.0	7.1/9.4	2.1/4.1	4.5/6.4	11.1/17.2
Sex							
Male	1.3/3.3	0.1/0.2	2.1/4.2	4.6/6.2	1.3/2.8	2.8/4.1	7.6/12.6
Female	2.9/6.7	0.1/0.2	3.3/5.7	9.5/12.4	2.8/5.4	6.0/8.6	14.3/21.4
Race–ethnicity							
White	2.3/5.6	0.1/0.2	3.0/5.5	7.5/9.9	2.2/4.6	4.4/6.3	11.7/18.4
Black	1.5/3.5	0.0 <sup>a</sup> /0.1	2.0/3.5	7.2/9.1	1.9/3.0	5.5/7.9	10.4/14.5
Native American	4.6/9.3	0.0/0.3	3.6/8.6	8.2/12.0	2.6/6.3	6.6/9.3	15.3/25.1
Asian	0.7/2.1	0.0/0.0 <sup>a</sup>	2.1/3.3	4.1/5.9	1.1/1.9	2.1/3.3	6.9/10.6
Hispanic	1.6/3.6	0.1/0.2	2.0/3.2	5.7/7.4	1.7/2.8	4.4/6.3	8.8/13.0
Age							
18–29	2.2/3.9	0.1/0.2	3.1/5.0	8.0/9.8	2.1/3.2	4.5/5.8	12.1/16.1
30–44	2.6/6.0	0.1/0.1	3.1/5.4	7.6/10.1	2.5/4.6	4.9/6.9	12.0/18.5
45–64	2.3/6.1	0.0 <sup>b</sup> /0.2	2.8/5.6	7.4/10.2	2.1/5.2	5.1/7.7	11.6/19.5
65+	0.8/2.8	0.0 <sup>b</sup> /0.1	1.6/3.0	7.5/6.1	1.0/2.6	2.6/4.1	6.9/11.7
Marital status							
Married/cohabiting	1.9/4.9	0.0 <sup>b</sup> /0.2	2.6/4.8	7.0/9.4	1.7/3.7	3.9/5.8	10.6/16.9
Widowed/separated/divorced	2.8/6.6	0.1/0.2	2.8/5.1	7.7/10.0	3.3/6.8	6.6/9.5	12.8/19.7
Never married	2.1/4.3	0.1/0.2	3.2/5.2	6.9/8.7	2.0/3.3	4.1/5.5	11.3/15.8
Education							
Less than high school	2.4/5.0	0.1/0.2	3.1/4.8	7.3/9.4	2.3/3.7	5.3/7.4	11.3/15.9
High school	2.0/5.2	0.0 <sup>b</sup> /0.2	3.0/5.4	7.1/9.0	2.3/4.3	4.4/6.1	11.3/17.0
Some college or higher	2.1/5.0	0.1/0.1	2.5/4.8	7.1/9.6	1.9/4.2	4.3/6.3	10.9/17.6
Personal Income							
\$0–19,999	2.8/6.2	0.1/0.2	3.3/5.5	8.3/10.7	2.6/4.6	5.9/8.1	13.0/18.9
\$20,000–34,999	1.7/4.3	0.1/0.2	2.6/5.2	7.0/9.1	1.9/3.9	4.0/5.8	10.5/16.7
\$35,000–69,999	1.5/4.2	0.0 <sup>b</sup> /0.0 <sup>b</sup>	2.2/4.2	5.7/8.1	1.5/3.9	3.3/5.1	8.9/15.4
\$70,000+	0.8/3.3	0.1/0.2	1.9/3.2	4.7/6.3	1.0/2.9	2.2/4.0	7.2/13.0
Urbanicity							
Urban	2.2/5.1	0.1/0.2	2.6/4.6	6.9/9.2	2.0/4.0	4.5/6.4	10.8/16.8
Rural	2.0/5.0	0.0 <sup>a</sup> /0.1	3.6/6.4	8.1/10.3	2.4/4.6	4.5/6.3	12.5/18.9
Region							
Northeast	2.4/5.6	0.1/0.2	2.2/4.3	6.2/8.3	1.8/3.5	4.7/6.7	9.9/16.3
Midwest	2.2/5.3	0.1/0.2	3.5/5.8	8.1/10.7	2.4/5.0	4.6/6.7	12.7/19.2
South	2.0/4.6	0.0 <sup>a</sup> /0.1	2.4/4.2	6.7/8.7	2.0/3.7	4.2/6.2	10.3/15.5
West	2.0/5.1	0.1/0.2	3.0/6.0	7.6/10.0	2.1/4.5	4.5/6.4	11.7/18.5

<sup>a</sup> All anxiety disorders except posttraumatic stress disorder (PTSD) were assessed at Wave 1. PTSD was assessed on a lifetime basis at Wave 2

<sup>b</sup> Actual value <0.05

unexpected relationship between income and alcohol abuse was explained by the “hazardous use” criterion (driving after drinking; evidently access to a car was limited to those with higher incomes; other abuse criteria were more prevalent at lower income levels, consistent with

dependence [95]. Other disorders were more prevalent among those with lower incomes.

The fundamental cause theory [96] posits that resources of higher socioeconomic status (knowledge, prestige, power, social connections) protect health



**Table 4** Prevalences of lifetime DSM-IV personality disorders by socio-demographic characteristics

Characteristic	Prevalence (%) lifetime									
	Antisocial <sup>a</sup>	Avoidant <sup>a</sup>	Borderline <sup>b</sup>	Dependent <sup>a</sup>	Histrionic <sup>a</sup>	Narcissistic <sup>b</sup>	Obsessive–compulsive <sup>a</sup>	Paranoid <sup>a</sup>	Schizoid <sup>a</sup>	Schizotypal <sup>b</sup>
Total	3.6	2.4	5.9	0.5	1.8	6.2	7.9	4.4	3.1	3.9
Sex										
Male	5.5	1.9	5.6	0.4	1.9	7.7	7.9	3.8	3.2	4.2
Female	1.9	2.8	6.2	0.6	1.8	4.8	7.9	5.0	3.1	3.7
Race-ethnicity										
White	3.6	2.4	5.6	0.5	1.8	5.0	8.3	3.7	2.8	3.5
Black	3.7	2.0	8.2	0.4	2.6	12.5	8.0	7.6	4.9	6.8
Native American	9.7	3.8	11.9	0.5	2.4	7.1	10.0	10.0	6.3	6.6
Asian	1.8	2.2	3.4	0.5	1.8	5.4	5.1	3.4	1.4	2.1
Hispanic	3.3	2.0	5.3	0.4	1.6	7.5	6.0	5.2	3.6	3.9
Age										
18–29	6.2	3.4	9.3	0.9	3.8	9.4	8.2	6.8	4.2	5.7
30–44	4.2	2.7	7.0	0.4	1.8	7.1	9.0	5.0	3.2	4.5
45–64	2.8	2.1	5.5	0.4	1.2	5.6	7.9	3.6	3.0	4.0
65+	0.6	0.8	2.0	0.3	0.6	3.2	5.2	1.8	1.7	1.5
Marital status										
Married/cohabiting	3.0	1.8	4.4	0.3	1.2	5.0	8.0	3.3	2.7	2.9
Widowed/separated/divorced	3.6	2.9	8.4	0.8	2.1	7.3	7.6	6.1	3.5	5.4
Never married	5.6	3.5	8.7	0.7	3.4	9.5	7.9	6.4	4.2	6.0
Education										
Less than high school	5.4	3.4	8.0	1.0	2.0	6.6	6.2	6.9	4.0	4.6
High school	3.9	2.8	6.8	0.6	2.1	5.9	7.3	5.0	3.3	4.2
Some college or higher	3.0	1.8	5.0	0.3	1.7	6.2	8.7	3.4	2.8	3.6
Personal income										
\$0–19,999	3.8	3.2	8.0	0.9	2.2	6.3	7.6	6.0	3.8	5.3
\$20,000–34,999	4.0	1.9	6.0	0.2	1.9	6.5	8.1	4.1	3.1	3.8
\$35,000–69,999	3.1	1.5	3.7	0.1	1.2	6.0	8.3	2.3	2.3	2.7
\$70,000+	2.8	0.8	2.4	0.1	1.1	5.3	8.0	1.8	1.7	1.6
Urbanicity										
Urban	3.6	2.2	6.0	0.5	1.9	6.3	7.9	4.33	3.1	3.9
Rural	3.7	3.0	5.6	0.6	1.7	5.8	7.9	4.8	3.2	3.9

Table 4 continued

Characteristic	Prevalence (%) lifetime									
	Antisocial <sup>a</sup>	Avoidant <sup>a</sup>	Borderline <sup>b</sup>	Dependent <sup>a</sup>	Histrionic <sup>a</sup>	Narcissistic <sup>b</sup>	Obsessive–compulsive <sup>a</sup>	Paranoid <sup>a</sup>	Schizoid <sup>a</sup>	Schizotypal <sup>b</sup>
Region										
Northeast	2.9	1.8	6.0	0.5	1.7	5.9	7.2	3.8	3.0	3.7
Midwest	3.8	2.8	5.8	0.4	2.0	5.9	8.3	4.6	3.2	3.8
South	3.2	2.3	5.6	0.5	1.7	6.2	7.4	4.6	3.2	3.8
West	4.7	2.5	6.2	0.6	2.1	6.6	8.8	4.5	3.1	4.4

<sup>a</sup> Data taken from NESARC Wave 1<sup>b</sup> Data taken from NESARC Wave 2

regardless of specific causal mechanisms present in any historical period. The inverse relationship between income and psychiatric/substance disorders is consistent with this theory. However, a bi-directional causal relationship may exist for substance use disorders, since early substance use impairs long-term cognitive functioning [97, 98], potentially diminishing the abilities needed to attain higher income.

### Urban vs. rural region

Other than social anxiety disorder (lower prevalence in urban areas [49]), the prevalence did not vary by the urban/rural distinction. Participants in the West had higher prevalence of alcohol and drug disorders than others. Whether this was due to greater alcohol or drug use in the West, or to higher risk for abuse/dependence among users is unknown. Region was unrelated to mood, anxiety, and personality disorders.

### Comorbidity

Over 150 publications addressed psychiatric and substance comorbidity in NESARC. The initial papers examined comorbidity broadly [30, 53, 99, 100]. Papers then used various strategies, including studying comorbidity associated with single disorders, with pairs or groups of disorders, subtypes of disorders, or specific symptoms. Other papers compared population subgroups.

“Clinical correlates” studies addressed comorbidity associated with single disorders (Tables 1, 2, 3, 4) [101–108]. Other studies examined associations of a specific subgroup of disorders with a single disorder [109–126]. Others addressed pairs of disorders, examining their relationships to each other and/or other comorbidity in detail [18, 46, 119, 127–138]. These studies all found considerable comorbidity.

Several studies examined comorbidity by disorder subtype [63, 139–142]. Depressive disorders had greater comorbidity when bipolar [143, 144] or “atypical” [145]. Studies of disorders subtyped by whether full or partial criteria were met found either that this did not affect comorbidity [52, 146, 147] or that those with partial criteria had intermediate likelihood of comorbidity [148, 149], suggesting heterogeneity.

Studies examined comorbidity associated with many specific symptoms: anhedonia [150], social isolation [151], panic attacks [152], hoarding [153], hazardous alcohol use [154], impulsivity [155], lack of remorse [156], shoplifting [157], firesetting [158], cruelty to animals [159], violent behaviors [160], nicotine withdrawal [161], and other symptoms or behaviors [162–166]. Participants with suicidality (ideation/behavior) had greater comorbidity than

others [166–185], as did smokers [69, 161, 170, 179, 186–200] and those who used alcohol/drugs to ameliorate mood/or feel better (self-medication) [201–209].

Studies comparing comorbidity in race/ethnic groups did not find consistent differences [210–214]. Studies limited to older participants showed considerable comorbidity; thus, this age group was no exception to the overall trend [215–225]. Surprisingly few papers focused on young adults [226, 227]; those that did also found comorbidity. Regardless of the focal disorder or symptom of the paper, studies addressing gender generally found greater internalizing comorbidity in women and externalizing comorbidity in men [57, 61, 67, 68, 228–230].

These papers are of interest to the field; with some cited 100s of times [30, 42–45, 53, 99, 231]. Overall, they tell a consistent story: comorbidity between pairs of disorders is the rule, not the exception. However, the association between two disorders is reduced or eliminated when models include other disorders as covariates, suggesting a more complex set of relationships than can be determined by examining disorders in pairwise fashion.

Prior to NESARC, multivariable investigation indicated two latent dimensional psychopathology types, internalizing (INT) and externalizing (EXT) [232]: EXT characterized by antisocial personality disorder and substance disorders, and INT characterized by distress (major depression, dysthymia, generalized anxiety) or fear (panic, social phobia, specific phobia). NESARC studies showed “distance” of INT and EXT disorders from each other [233], and invariance of the INT/EXT domain structure by gender [234] and race/ethnicity [235]. NESARC studies also expanded understanding of the INT/EXT structure by investigating new disorders. Borderline personality disorder fell within both EXT and INT domains [236], suggesting a complex etiology. Pathological gambling loaded on EXT for men and women [237], while the best model fit for women also allowed it to load on INT [237]. Non-medical prescription drug disorders loaded on EXT in men and women [238]. ADHD loaded on EXT [239]. Narcissistic personality disorder loaded mainly on INT, although a subtype, grandiose narcissism, loaded on INT and EXT [240]. A third “thought disorder” domain included bipolar disorder, schizoid, schizotypal, paranoid, and avoidant personality disorders [241], consistent with a large clinical study [242]. Alcohol dependence was related to INT “load” rather than specific INT disorders [243]. Finally, associations between child maltreatment types and psychiatric disorders were fully mediated through the latent INT and EXT domains [244].

These studies suggest value in investigating etiology via the trans-diagnostic domains rather than individual disorders. However, disorders with connection to both INT or

EXT domains may require a different approach. Finally, within a domain, the fact remains that some individuals manifest symptoms of one disorder, but not another. Better understanding the factors underlying different clinical presentations within a domain may advance our understanding of etiology and treatment.

### Time (secular) trends in the prevalence of disorders

The availability of data from NLAES [21–23] permitted examination of secular changes over time by testing whether prevalence differed between NLAES and NESARC.

#### *Alcohol*

Compared to NLAES, the prevalence of drinkers was higher in NESARC. Among regular drinkers, the prevalence of heavy drinking was higher in NESARC than NLAES [245]. Compared to NLAES, the prevalence of alcohol abuse was higher in NESARC, while the prevalence of dependence was lower [246]. Driving after drinking was less prevalent in NESARC than in NLAES [247]. Treatment utilization for alcohol disorders was low and unchanged in NLAES and NESARC [42], with blacks and Hispanics particularly underutilizing services [248]. A study of gender differences in AUD course showed little evidence of “telescoping” (i.e., more rapid transition from first use to disorder and/or treatment in women) [249]. AUD prevalence changed little across male birth cohorts, but was increased in recent female birth cohorts [250]. Thus, treatment underutilization and women “catching up” to men were areas of concern.

#### *Drugs and tobacco*

The prevalence of marijuana use was similar in NLAES and NESARC (~4.0%), but the prevalence of marijuana use disorder increased in NESARC by about 20% [251], speculatively attributed to increasing marijuana potency over time leading to increased risk among users [251]. The prevalence of non-medical prescription drug use (NMPDU) and NMPDU disorders increased in NESARC compared to NLAES [252], as did the prevalence of opioid NMPDU disorder [253]. NMPDU disorders and illicit substance disorders co-occurred more in NESARC than in NLAES [101]. Treatment utilization for drug disorders increased in NESARC, but remained underutilized [43]. The prevalence of daily tobacco use was lower in NESARC than NLAES, but the decrease was less among those with comorbidity [254]. The divergent time trends by substance suggest changing societal forces differentially influencing risk for specific substance disorders that warrant further investigation.

### *Affective conditions*

The prevalence of major depression was greater in NESARC than NLAES [255]. The prevalence of suicide attempts overall did not differ between NLAES and NESARC [256], but did increase in Puerto Ricans and Cubans [257], highlighting Hispanic heterogeneity.

### **Prospective course: Wave 1/Wave 2 comparisons**

High rates of incidence of several disorders were shown, with risk factors similar to those for prevalence [31]. Wave 2 data then provided a unique opportunity to further study *recovery, persistence, relapse, and incidence*.

### *Alcohol recovery*

Of those with Wave 1 AUD, ~18 % tried to stop drinking by Wave 2 [258]. Wave 1 factors predicting Wave 2 drinking cessation were: absence of comorbidity [258], [259] recent childbearing, lower drinking amounts; and non-white race/ethnicity [259]. Among those with Wave 1 alcohol dependence, factors predicting Wave 2 abstinent recovery (no drinking or symptoms) were minority race/ethnicity, having young children, religious involvement, and treatment/12-step participation [260]. Factors predicting non-abstinent recovery (some drinking, no symptoms) were job problems/unemployment, drinking quantity, and smoking [260]. *Persistence*. Predictors of Wave 2 persistent alcohol dependence were: childhood maltreatment [261], personality disorders [262], perceived alcoholism stigma [32, 33] and low social support [263], being a non-US born minority [264], and drinking to alleviate mood/anxiety symptoms [201, 202]. *Relapse*. Among those with Wave 1 remission from past alcohol dependence, factors predicting Wave 2 relapse were any Wave 1 drinking, (in older respondents), younger age, regardless of drinking [265], and recent divorce/marital separation [266]. *Incidence*. Wave 1 factors predicting incident alcohol problems/dependence were: risk drinking ( $\geq 5$  drinks for men,  $\geq 4$  for women), social harms, comorbidity [265], drinking to alleviate mood/anxiety symptoms [201, 202], earlier drinking onset [267], financial/economic stressors [268], and partial dependence symptoms [269]. Thus, transitions and continuity were related to a nexus of comorbidity, socio-demographic characteristics, social support, and stress.

### *Drugs and nicotine*

Overall, Wave 1–Wave 2 transitions in drug use were common, predicted by alcohol, drug, and psychiatric comorbidity [270]. *Recovery*. Refuting clinical concerns

that remission from one drug disorder leads to “substitution” with another, Wave 2 remission from drug disorders actually predicted *lower* risk of a new, different drug disorder [271]. *Persistence*. Comorbidity predicted persistent cannabis disorder [272], smoking [188], and nicotine dependence [273–275]. Smoking during pregnancy also predicted smoking persistence [276]. The persistence of smoking suggested inadequacies of policies to assist quitting [277]. *Relapse*. Comorbidity predicted relapse of cannabis disorders [278] and smoking [188]. Younger age at smoking cessation and shorter abstinence predicted smoking relapse [279]. *Incidence*. Divorce, alcohol, and nicotine-related problems predicted cannabis use onset, while religious and pro-social activities were protective [280]. Comorbidity predicted smoking initiation [274, 275] and daily smoking onset [69]. Thus, comorbidity played an important role in transitions in drug and nicotine use and disorders. Socio-demographic characteristics, social support, and stress also played a role, although these were examined less and warrant greater research attention.

### *Psychiatric disorders recovery*

Most of those with Wave 1 major depression remitted by Wave 2 [281]. *Persistence*. Comorbidity predicted persistent mood and anxiety disorders [282–284]. Persistent major depression was also predicted by childhood sexual abuse and early onset [281]. In older adults, persistent mood and anxiety disorders were predicted by physical and mental comorbidity [224]. Persistent antisocial symptoms were predicted by being unmarried, low SES, and comorbidity [285]. *Relapse*. Wave 1 financial/economic and interpersonal stressors increased risk for relapse of depression [268]. Being female, younger, and financial crises predicted relapse of panic disorder [286]. Brief bereavement-related depressive episodes did *not* predict Wave 2 depression [287]. *Incidence*. Being female, younger, and financial crises predicted incidence of panic disorder [286]. Wave 1 panic attacks predicted incident suicidality [168]. About 5 % of participants with major depression transitioned to bipolar disorder by Wave 2, predicted by a history of childhood abuse, anxiety disorders, recent disruption of social supports, and financial problems [288, 289]. Again, a nexus of comorbidity and psychosocial conditions played important roles in persistence and transitions.

### *Functioning*

Across disorders, Wave 2 remissions were associated with improved functioning [290]. However, functioning associated with remission continued to be poorer than among those without previous disorders [290], indicating residual impairment even after symptomatic resolution.

## Adverse childhood experiences and stress sensitization as risk factors

Forty-five NESARC papers addressed childhood abuse, neglect, and other adverse childhood experiences, finding relationships between childhood abuse or neglect and risk for adult disorders [66, 289, 291–294], even in older adults [295]. Childhood abuse or neglect also predicted chronic course of disorders [261, 296–298]. Studies of the “stress sensitization” theory [299] showed that those exposed to childhood abuse/neglect evidenced greater vulnerability to adult disorders or symptoms after experiencing adult stressors [253, 289, 299–302]. Studies also showed the harmful effects of harsh punishment and physical abuse [303–306]. Childhood stressors not involving direct maltreatment were also harmful, including parental loss [215–217], witnessing parental violence [307], and parental divorce [174, 294, 308–310]. Implications of this research are twofold: first, research on neurodevelopmental processes is needed to determine mechanisms of these effects; and second, public education is needed to inform parents about potential effects of common experiences (e.g., harsh physical punishment, divorce) on their children.

## Treatment utilization

Most individuals with alcohol, drug, or psychiatric disorders received no treatment.

### Alcohol

Treatment rates for AUD was low (<20 %) and unchanged over time [42]. Treatment types changed over time: acute-care services increased, while private professional services and 12-step groups decreased [248]. Those with alcohol dependence before age 30 were unlikely to receive treatment [311], as were blacks [248], Hispanics [248, 312], and women [313, 314]. Substance and psychiatric comorbidity predicted treatment [314–317] and equalized black/white differences [318, 319]. Medical comorbidity [320], including injury [321], also predicted alcohol treatment. Comorbidity predicted perceived need for treatment [316, 317, 320, 322], while attitudinal barriers to receiving treatment included perceived stigma of alcoholism [323] and lack of perceived need for treatment [317, 320, 322]. Findings suggest considerable need for greater public education to reduce stigma and thereby improve treatment utilization. Those receiving alcohol treatment typically did so from multiple sources [324]. Of those treated, 15 % received this from clergy; predictors included being black, middle aged, and comorbid, suggesting the need to train clergy to effectively address alcohol disorders [325].

### Drugs

Treatment utilization was low in whites [326] and all Latino subgroups [312, 327]. Longer duration and comorbidity predicted treatment [328, 329]. Non-whites were more likely than whites to perceive a need for treatment [328] and to receive treatment [318, 319, 326, 327], often from 12-step groups or clergy [326]. Again, attitudinal barriers were important: participants perceiving a need for treatment were more likely to use services than others, while among participants perceiving a need, those with pessimistic attitudes about treatment outcomes were less likely to use services [330], supporting the need for public education. Other barriers, including financial barriers and fear of social consequences, were not significantly associated with treatment [330].

### Psychiatric disorders

Whites, females, and middle-aged participants were more likely than others [319, 331–333] to be treated for PTSD, mood and anxiety disorders [334], as were females [331, 335, 336] and middle-aged participants [335]. Among those with depression, treatment was more likely among those with substance use disorders [331], while suicidal behavior led to emergency services but not outpatient treatment [337]. Treatment for mood or anxiety disorders was less likely among those with personality disorders and more likely with anxiety comorbidity [335, 338]. Use of emergency and hospital services was elevated among those with personality disorders, even after adjustment for Axis I disorders [339].

Overall, treatment and factors predicting treatment differed sharply between substance and psychiatric disorders. While participants could choose financial barriers to explain their lack of alcohol or drug treatment, attitudinal barriers, including stigma, emerged as a most important predictor of lack of treatment. All results support the need for better public education about treatment and its efficacy.

### DSM-5

Psychiatric epidemiology has been intimately tied to DSM criteria for psychiatric and substance use disorders since the ECA, with ECA, NCS and NCS-R assessing DSM-III, DSM-III-R, and DSM-IV criteria, respectively. AUDADIS measures in the large NLAES and NESARC sample sizes provided uniquely detailed data on AUD/SUD criteria that contributed important knowledge to the DSM-5 decision-making process.

NESARC indicated that not all individuals with dependence also met criteria for abuse [17, 18], suggesting that traditional ways of conceptualizing these two disorders were incorrect. In addition, diagnostic “orphans” (one or

two dependence criteria; no abuse or dependence diagnosis) were another problem. An early NLAES report examined current and lifetime criteria suggested that “orphans” could not be validly combined with those who had no diagnosis and no criteria [340]. NESARC papers confirmed this [341–344], so the diagnostic “orphan” issue required attention in DSM-5 [345].

One of the major decisions faced by the DSM-5 substance disorders workgroup was whether to keep abuse and dependence separate or combine them in some way [345]. To inform this decision, one of the primary types of analysis was item response theory (IRT) analysis. IRT studies of NESARC data were consistent across substances: all abuse criteria except legal problems and all dependence criteria were unidimensional, with abuse and dependence criteria intermixed across the severity spectrum [136, 345–352], supporting a change to a single SUD indicated by dependence and abuse criteria [345]. Other analytic methods addressing this question yielded similar results, supporting a single disorder that combined the criteria [138, 142, 353–355]. While dissenting voices can always be found for any DSM decision [356, 357], the weight of the evidence favoring a single disorder combining abuse and dependence criteria was overwhelmingly strong [345].

Numerous studies attempted to identify AUD or SUD subtypes. Although many subtypes are possible due to different combinations of abuse and dependence criteria, the number that actually occurs is lower [141, 358]. Latent class analysis was a popular method to search for categories or subtypes [140, 359–363], but these generally identified categories based on severity, as did taxometric analyses [364, 365].

NLAES and NESARC studies also considered individual criteria. Craving [345, 366, 367] fit well with existing criteria, although whether it added unique information was unclear. Papers addressing hazardous use (largely driving after drinking) raised questions about this criterion [94, 154, 368], but not sufficient to justify removing it from DSM-5. Two NESARC papers supported adding cannabis withdrawal to DSM-5 [369, 370]. Adding a criterion representing use per se was examined in NESARC for several substances [371–374]. While unidimensional with the other criteria, use as a criterion was problematic, so it was not added to DSM-5 [345]. In addition, many of the IRT studies addressed differential item functioning (DIF) by population subgroup status, largely gender and race/ethnicity. While these studies found DIF for some criteria, the findings were sufficiently heterogeneous that no overall effect was exerted on the diagnosis [345]. Some studies focused more specifically on DIF or related issues, including by age, gender, US vs. other status, and major depression [58, 348, 375, 376]. These studies suggested

further study, thus indicating a direction for future research.

Some studies used NESARC data to check the agreement between DSM-IV and DSM-5 AUD and SUD diagnoses [345, 377–379], which was found to be quite high. This work was recently replicated [380] using data from the NESARC-III, a 2012–2013 study of 36,309 new participants described further below.

As is always the case when a new DSM is published, many DSM-5 issues remained to be investigated empirically [345]. For this purpose, studies incorporating the new DSM-5 measures should be used.

## Conclusion

The enormous scope of NESARC-based studies precluded inclusion of many important and informative studies in this review that did not fit easily within the categories examined. Some of these warrant review later. These include:

- early onset and its implications for later psychopathology [125, 292, 381–400];
- Gambling disorders [63, 146, 162, 228, 231, 237, 398, 401–423];
- generalizability of clinical trial samples [424–431];
- obesity [304, 432–436];
- relationship of substance and psychiatric disorders to economic conditions [437–439], employment/income [95, 331, 414, 437, 440–447], education [69, 448–453], and homelessness [454–456];
- sexual orientation, related behaviors [448, 457–473], and other sexual risk behaviors [458, 474–476];
- self-reported medical conditions [135, 162, 183, 304, 411, 419, 447, 477–503], including HIV/other sexually transmitted diseases [447, 461, 504–508] and injury [267, 509–511];
- screening, including for psychiatric [409, 512–517], alcohol [195, 518–526], and substance disorders [527];
- social/contextual effects on individual psychopathology [77, 151, 263, 280, 289, 447, 467, 528–534], including laws and policies [466, 468, 469, 535–542].

From these and the papers reviewed above, epidemiologic knowledge of alcohol, drug, and psychiatric conditions has advanced greatly through studies of NESARC data.

NESARC takes its place as a culmination of third-generation psychiatric epidemiologic studies in terms of sampling and measurement, and in its integration of research on alcohol and drug patterns/problems with psychiatric epidemiology. In particular, comorbidity was examined initially controlling for psychiatric disorders and then addressing the disorders in a multivariable manner.

Further, the many findings on similarities and differences between population groups were derived from analyses of a uniform source of information on the different groups, which were sampled in large enough numbers to do so.

Two key future research directions are needed. First, to better understand the etiology, large-scale fourth-generation surveys will need to incorporate biological variables to examine as main effects and as factors that modify (or be modified by) larger environmental factors such as social norms, laws, the physical environment, and economic conditions. The 2012–2013 NESARC-III is such a study, including 36,309 new participants [543–547] from whom diagnostic, risk factor, and DNA data were collected. The NIH Adolescent Brain and Cognitive Development (ABCD) study will incorporate interview and DNA assessments, repeated brain imaging, and a longitudinal design.

The second key direction will be the continuing need to update prevalence, risk factor, and treatment utilization data. Smoking norms and laws are likely to continue to become more restrictive. In contrast, marijuana norms and laws are rapidly becoming more permissive. National data monitoring trends in use of and addiction to these substances will be needed. Further, non-medical prescription opioid use and addiction may continue to grow as the baby boom cohort enters late adulthood, experiencing age-related medical problems and associated pain. A NESARC-IV could possibly provide such information, although planning for such a study is not yet underway. Finally, NESARC has clearly shown the lack of treatment for alcohol and drug disorders. Improving insurance coverage for such care is important. However, public education appears more important to de-stigmatize alcohol and drug disorders [548], and increase awareness that treatment is effective and available [549]. Educating health professionals about these issues is also important. Continued monitoring of alcohol and drug treatment utilization through surveys will be needed to determine if efforts to improve the use of care are successful, and to identify continuing barriers to care.

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