Rates and Correlates of Relapse Among Individuals in Remission From DSM-IV Alcohol Dependence: A 3-Year Follow-Up

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Background: There is little information on the stability of abstinent and nonabstinent remission from alcohol dependence in the general U.S. population. The aim of this study was to examine longitudinal changes in recovery status among individuals in remission from DSM-IV alcohol dependence, including rates and correlates of relapse, over a 3-year period.

Methods: This analysis is based on data from Waves 1 and 2 of the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC), a nationally representative sample of U.S. adults aged 18 years and older originally interviewed in 2001 to 2002 and reinterviewed in 2004 to 2005. The Wave 1 NESARC identified 2,109 individuals who met the DSM-IV criteria for full remission from alcohol dependence. Of these, 1,772 were reinterviewed at Wave 2, comprising the analytic sample for this study. Recovery status at Wave 2 was examined as a function of type of remission at Wave 1, with a focus on rates of relapse, alternately defined as recurrence of any alcohol use disorder (AUD) symptoms and recurrence of DSM-IV alcohol dependence. Logistic regression models were used to estimate the odds of relapse among asymptomatic risk drinkers and low-risk drinkers relative to abstainers, adjusted for a wide range of potential confounders.

Results: By Wave 2, 51.0% of the Wave 1 asymptomatic risk drinkers had experienced the recurrence of AUD symptoms, compared with 27.2% of low-risk drinkers and 7.3% of abstainers. Across all ages combined, the adjusted odds of recurrence of AUD symptoms relative to abstainers were 14.6 times as great for asymptomatic risk drinkers and 5.8 times as great for low-risk drinkers. The proportions of individuals who had experienced the recurrence of dependence were 10.2, 4.0, and 2.9%, respectively, and the adjusted odds ratios relative to abstainers were 7.0 for asymptomatic risk drinkers and 3.0 for low-risk drinkers. Age significantly modified the association between type of remission and relapse. Differences by type of remission were not significant for younger alcoholics, who had the highest rates of relapse.

Conclusions: Abstinence represents the most stable form of remission for most recovering alcoholics. Study findings highlight the need for better approaches to maintaining recovery among young adults in remission from alcohol dependence, who are at particularly high risk of relapse.

Key Words: Alcohol Dependence, Remission, Relapse.

MOST STUDIES OF relapse following recovery from alcohol dependence have been based on treatment samples. Estimated rates of relapse have varied widely in relation to follow-up interval and definition of relapse (see reviews in Bradizza et al., 2006; McKay et al., 2006; McKay, 1999; Tonneato et al., 1992; Walitzer and Dearing, 2006), typically lying in the range of 40 to 60% within the first few months after treatment and as high as 70 to 80% by the end of 1 year. In studies with follow-up intervals of 2 years or longer, abstinence rates of approximately 30% have been noted at the ultimate follow-up point (Mann et al., 2005; Miller et al., 2001; Project MATCH Research Group, 1998), with multiple shifts between periods of abstinence and problematic drinking reported by one-quarter to one-half of the participants (Dennis et al., 2003; McKay and Weiss, 2001). Mann et al. (2005), who evaluated the recovery status of a group of 96 patients over the course of 16 years following alcohol treatment, noted that the recovery category of "improved drinking" was highly inconsistent over time, whereas the categories of abstinent and unimproved remained quite stable.

In a long-term follow-up study of previously untreated individuals with alcohol use disorders (AUDs), who were interviewed when they first made contact with the alcohol treatment system through either a referral service or detoxification program (n = 461), there were substantial rates of both remission and subsequent relapse over the course of 16 years (Moos and Moos, 2006). Among individuals in remission at the 3-year follow-up interview, 42.9% of those

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who had received treatment in the year following the initial contact had experienced a relapse by year 16. The rate of relapse was considerably higher, 60.5%, among those who had not received treatment. Although not formally a treatment sample, in that not all sample members actually sought help after the initial contact, neither is this a true population sample. Studies of the U.S. and Canadian general populations have shown that only a small proportion of adults classified with AUDs make any contact at all with the formal treatment or self/mutual-help systems (Cunningham, 1999; Dawson et al., 2005; Grant, 1997a; Sobell et al., 1996) and that the individuals who do seek help are highly selected with respect to severity of AUD and psychiatric comorbidity (Grant, 1996, 1997b). Accordingly, the rates of relapse reported by individuals making even an initial contact with the treatment system cannot be safely generalized to the total population.

Complementing the treatment literature is a broad body of research into the process of natural recovery, i.e., recovery without formal treatment. However, the samples used in these studies do not represent the general population, both because they exclude individuals who have sought help for their drinking problems and because most are based on convenience samples, often obtained by means of media solicitation. Moreover, in a review of 38 natural recovery studies, Sobell et al. (2000) reported that only 2 had included information on relapse.

Data on relapse following recovery from alcohol dependence in general population samples are scarce. In a 24-month longitudinal study of individuals identified as risk drinkers during baseline telephone screening, participants were reinterviewed by telephone every 6 months (Booth et al., 2001). The majority of those with an AUD at baseline ($n = 199$) either remained dependent at all subsequent interviews (9.1%) or remained consistently without disorder once remission had been achieved (69.4%). The remaining 17.5% experienced a recovery followed by a relapse. Of the 254 individuals who achieved recovery from an AUD at *any* point during the follow-up, including those who developed a disorder after the baseline interview, the rate of relapse was similar, 18.1%. These findings were based on unweighted respondent profiles from a sample that was restricted to a single region of the United States, and they excluded individuals who had received alcohol treatment or participated in 12-step programs during the follow-up period. Thus, they share some of the limitations of natural recovery studies and may not accurately represent probabilities of relapse for the general U.S. population.

In a sample of individuals 55 to 65 years of age, who sought general outpatient medical care at 1 of 2 facilities (Schutte et al., 2003), 447 individuals classified as former problem drinkers at baseline were followed for a period of 10 years. Of those who survived, 11% relapsed during the 10-year follow-up. The likelihood of relapse was greater among those who were nonproblem drinkers at baseline than for those who were abstainers, and rates of relapse increased with level of consumption. In his long-term follow-up studies of college students and inner-city men, Vaillant (2003) found that 41% of the 56 alcohol abusers in the 2 samples who had been abstinent for at least 2 years eventually relapsed, but that relapse after year 7 was rare. He also reported that nonabstinent recovery was less stable, usually resolving into either relapse or abstinence. Again, these studies may not represent probabilities of relapse than can be generalized to the U.S. population as a whole, as both were based on community samples that were neither designed nor weighted to be nationally representative.

A recent study based on data collected in the Netherlands Mental Health Survey and Incidence Study (NEMESIS) provided information on the 3-year course of AUDs in a nationally representative Dutch population sample ($n = 4{,}214$ at the 3-year follow-up). Among respondents with DSM-IV dependence (American Psychiatric Association, 1994) at baseline and no AUD at year 1 ($n = 22$), the authors reported that 13.6% had experienced the recurrence of dependence and 4.5% met the criteria for abuse at year 3 (De Bruijn et al., 2006). Although the combined relapse rate of 18.1% (for recurrence of any AUD) is identical to the findings of the study by Booth et al., (2001), which used a comparable follow-up period, the small number of individuals in remission from an AUD at year 1 detracts from the precision of the NEMESIS relapse estimates.

In the United States, the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC) conducted 2 waves of interviews approximately 3 years apart with a general population sample of adults aged 18 years and older at Wave 1 ($n = 43{,}093$). Based on retrospective data from the 2001 to 2002 Wave 1 NESARC, Dawson et al. (2005) reported that nearly half (47.7%) of the individuals who had previously met the DSM-IV criteria for alcohol dependence were in full remission from dependence during the year preceding interview. This included 11.8% who were classified as asymptomatic risk drinkers on the basis of their volume and/or pattern of drinking, 17.7% who were classified as low-risk drinkers and 18.2% who were abstainers. The rate of remission increased steadily from 10.5% among those interviewed within 5 years after onset of dependence to 73.0% of those interviewed 20 or more years after onset, and the ratio of abstainers to low-risk drinkers also increased over time since onset of dependence. The proportions with multiple episodes of dependence, 26.0% of those who had never sought help for their alcohol problems and 36.3% of those who had ever sought help, indicated substantial rates of prior relapse (Dawson et al., 2006).

Consistent with the conceptual framework proposed by Delucchi et al. (2004, 2007), comprising (i) individual factors (both sociodemographic and severity measures), (ii) formal treatment services, and (iii) informal influences (including both 12-step participation and social networks) as correlates of the recovery process, measures related to each of these 3 factors demonstrated significant associations with the likelihood of achieving recovery from alcohol dependence in earlier analyses of the Wave 1 NESARC. These included age,

sex, college education, family history of alcoholism, age at onset of dependence, severity of dependence, alcohol treatment and 12-step participation. In addition, race, college education, severity, other substance use and treatment/12-step participation discriminated between abstinent and nonabstinent recovery (Dawson et al., 2005, 2006).

Data from the 2004 to 2005 Wave 2 NESARC provide an opportunity to assess the risk of relapse in a prospective design for this nationally representative sample. Of the 2,109 individuals who met the DSM-IV criteria for full remission from alcohol dependence at Wave 1, this study investigates those who were reinterviewed at Wave 2 (n = 1,772). It first tests whether type of remission was associated with the likelihood of reinterview and then examines the status of the reinterview sample in the year preceding the Wave 2 interview relative to their type of remission at baseline, i.e., in the year preceding the Wave 1 interview. It also examines rates of relapse, alternately defined as (i) the recurrence of any AUD symptoms and (ii) the recurrence of DSM-IV alcohol dependence, at any time between the Wave 1 and Wave 2 interviews, testing the following hypotheses:

1. Based on assumption that asymptomatic risk drinking represents levels and patterns of consumption thought to increase the risk of relapse, we hypothesize that rates of relapse will be highest among individuals classified as asymptomatic risk drinkers at baseline.
2. Because the increasing ratio over time of abstainers to low-risk drinkers found in the Wave 1 NESARC suggests that abstinence may be the more sustainable form of recovery, an argument supported by the findings of other longitudinal studies (Schutte et al., 2003; Vaillant, 2003), we hypothesize that the rates of relapse will be higher for low-risk drinkers than for abstainers.
3. Based on the argument that recovery should not be considered as "stable" until after a specified amount of time, e.g., 5 years (Sobell et al., 2000), and prior studies indicating that the risk of relapse declines as the duration of remission increases (see review in Finney et al., 1999), we hypothesize that the risk of relapse will be inversely related to the duration of remission at baseline. That is, we expect that those with the most recent recoveries at Wave 1 will be the most likely to have relapsed by Wave 2.

In addition to testing these hypotheses, we examine whether the individual, formal treatment and informal support factors that were associated with type and likelihood of recovery at baseline had an independent effect on the likelihood of relapse, or whether their association with relapse was mediated by type of remission.

MATERIALS AND METHODS

Sample

The data for this analysis come from Wave 2 of the NESARC, designed by the National Institute on Alcohol Abuse and Alcoholism and conducted in 2004 to 2005. The original 2001 to 2002 Wave 1 NESARC sample consisted of 43,093 U.S. adults aged 18 years and older, representing the population residing in households and noninstitutional group quarters in all 50 states and the District of Columbia (response rate = 81.0%). In Wave 2, interviewers trained by the U.S. Bureau of the Census attempted to reinterview all eligible respondents from Wave 1, i.e., all those who had not died, become incapacitated or institutionalized, entered the military, or moved out of the United States. (n = 39,959 eligibles). The reinterview rate among these eligibles was 86.9%, yielding a Wave 2 sample of 34,653 U.S. adults and a cumulative response rate over the 2 surveys of 70.2%. Sample weights for Wave 2 were calculated so as to ensure that the weighted Wave 2 sample represents survivors of the original sample who remained in the noninstitutionalized U.S. population (Grant et al., 2007).

All potential NESARC respondents were informed in writing about the nature of the survey, the statistical uses of the survey data, the voluntary aspect of their participation and the Federal laws that rigorously provide for the confidentiality of identifiable survey information. Only respondents consenting to participate after receiving this information were interviewed. The research protocol, including informed consent procedures, received full ethical review and approval from the U.S. Census Bureau and the U.S. Office of Management and Budget.

Like the Wave 1 NESARC, the Wave 2 survey collected data in personal interviews conducted in respondents' households. The interview spanned alcohol use and alcohol use disorders, tobacco and drug use and disorders, mood, anxiety and personality disorders, and general health. New sections included posttraumatic stress disorder, attention-deficit hyperactivity disorder, and personality disorders not included in Wave 1. The Wave 2 questionnaire also included questions on various types of discrimination, acculturation, domestic violence, childhood abuse, sexual orientation, and changes in sociodemographic indicators.

This analysis is based on a subsample of the Wave 1 NESARC respondents who were in full remission from prior DSM-IV alcohol dependence in the year immediately preceding the Wave 1 interview (n = 2,109, of whom 1,772 were reinterviewed in Wave 2), i.e., who no longer had any symptoms of dependence or abuse.

Measures

DSM-IV Alcohol Abuse and Dependence: Alcohol use disorders and remission were defined in accordance with the DSM-IV criteria (American Psychiatric Association, 1994), using the Alcohol Use Disorders and Associated Disabilities Interview Schedule —DSM-IV Version (AUDADIS-IV, Grant et al., 2001). To be classified with alcohol dependence during a specific time period, respondents had to report that one or more symptoms of at least 3 of the following criteria occurred during that period: (i) tolerance, (ii) withdrawal (2+ symptoms *or* drinking to relieve or avoid withdrawal), (iii) persistent desire or attempts to reduce or stop drinking, (iv) much time spent drinking or recovering from drinking, (v) reduction/cessation of important activities in favor of drinking, (vi) impaired control over drinking, and (vii) continued use despite physical or psychological problems caused by drinking. For time periods whose duration was greater than 1 year, respondents had to report that some of these experiences happened "on and off for a few months or longer," "most days for at least a month," or "within the same 1-year period." To be classified with abuse during a specific time period, respondents had to report the occurrence of at least 1 symptom of any of the 4 abuse criteria: (i) continued use despite interpersonal problems caused by drinking, (ii) recurrent hazardous use, (iii) recurrent alcohol-related legal problems, and (iv) inability to fulfill major role obligations because of drinking. In a test–retest reliability study, reliability for the prevalence of lifetime alcohol use disorders was good, kappa = 0.74 (Grant

et al., 2003). Other studies have demonstrated the concurrent and construct validity of the AUDADIS-IV (Cottler et al., 1997; Hasin et al., 1997; Muthen et al., 1993; Nelson et al., 1999; Pull et al., 1997).

Recovery Status: Recovery status was defined according to the categories listed below. The rationale for these categories has been presented elsewhere (Dawson et al., 2005).

1. *Still dependent*: Fulfilled the DSM-IV criteria for alcohol dependence, as defined above.
2. *Partial remission*: Did not meet the criteria for alcohol dependence, but reported 1+ symptoms of either alcohol abuse or dependence.
3. *Asymptomatic risk drinker*: Did not experience any symptoms of alcohol abuse or dependence but met the criteria for risk drinking as defined in *Helping Patients with Alcohol Problems: A Health Practitioner's Guide* (NIAAA, 2004): 14+ drinks per week or 5+ drinks on any day for men and 7+ drinks per week or 4+ drinks on any day for women, assuming a standard drink size of 0.6 ounces of ethanol.
4. *Low-risk drinker*: Consumed alcohol but did not experience any symptoms of abuse or dependence and did not meet the criteria for risk drinking specified above.
5. *Abstainer*: Did not consume any alcohol.

As per the DSM-IV criteria (American Psychiatric Association, 1994), individuals were classified as being in full remission if they were in categories 3, 4 or 5.

Relapse: Individuals were counted as positive for recurrence of any AUD symptoms, if they were classified in categories 1 or 2 during either the year immediately preceding the Wave 2 interview or the approximately 2-year period since the Wave 1 interview but before the year preceding the Wave 2 interview. They were counted as positive for recurrence of DSM-IV alcohol dependence, if they were classified in category 1 during either of these 2 periods.

Covariates: Covariates representing individual-level factors, formal treatment and informal support (Delucchi et al., 2004, 2007) were considered as potential confounders of the association between type of remission and the likelihood of relapse. These factors, all measured as of baseline (the year preceding the Wave 1 interview) unless otherwise specified, were as follows: age, gender, race/ethnicity, marital status, college education, tobacco use, drug use, family history of alcoholism, DSM-IV mood, anxiety and personality disorders, early initiation of drinking (before age 15), interval from first drink to onset of dependence, duration of dependence, duration of remission, history of prior relapse (as indicated by multiple episodes of dependence), severity of dependence (as measured by number of lifetime symptoms *prior* to the year immediately preceding the Wave 1 interview), volume of ethanol intake during period of heaviest drinking, and lifetime history of having obtained help for alcohol problems (including both formal treatment and participation in Alcoholics Anonymous or other 12-step/mutual help programs). Their derivation and psychometric properties have been described in detail elsewhere (Dawson et al., 2005, 2006).

Analysis: Bivariate and multivariate analyses were performed using SUDAAN (Research Triangle Institute, 2001), a software package that uses Taylor series linearization to adjust variance estimates for complex survey designs. To examine the association between baseline type of remission and the likelihood of being reinterviewed, Wave 1 data were used with Wave 1 weights. These results can be generalized to all U.S. adults living in household and selected group quarters, as described previously. The remaining analyses of follow-up recovery status and risk of relapse were based on Wave 2 data and Wave 2 weights, making them representative of survivors of the original sample, i.e., of individuals 18 and over at Wave 1 who remained alive and living in households and noninstitutional group quarters at Wave 2. For the multivariate analyses, model fit was improved by recoding the age variable so that all ages 55 and older were recoded to 55 years.

RESULTS

Of the individuals in remission from DSM-IV alcohol dependence at baseline, 24.8% were classified as asymptomatic risk drinkers, 36.8% were low-risk drinkers and 38.4% were abstainers (Table 1). Although the baseline recovery status of the reinterview sample was similar to that of the initial sample, it was slightly underrepresentative of those who abstainers (36.5%) and slightly overrepresentative of those who were asymptomatic risk drinkers (25.1%) and low-risk drinkers (38.4%). These discrepancies reflect significant variation by type of remission in the probability of being reinterviewed at Wave 2, $\chi^2 = 12.0$, df = 2, $p = 0.004$. Specifically, abstainers had increased likelihoods of having died and having become institutionalized or incapacitated, reflecting their older ages (data not shown).

As shown in Table 2, recovery status at Wave 2 varied strongly as a function of type of remission at baseline ($\chi^2 = 165.6$, df = 8, $p < 0.001$). Those who had been asymptomatic risk drinkers were as likely to have developed AUD symptoms, putting them in the category of partial remission (33.9%), as to still be asymptomatic risk drinkers (31.3%). Almost half (48.3%) of the baseline low-risk drinkers remained in that category at Wave 2, but 18.3% had become abstainers and 19.2% had developed abuse and/or subclinical symptoms of dependence. The baseline abstainers were the most stable category, with 77.2% still abstainers at Wave 2.

Overall, 85.7% of the individuals represented by the Wave 2 reinterview sample were in the same category of recovery status in both of the time periods between the Wave 1 and Wave 2 interviews, i.e., in the 12 months preceding the Wave 2 interview and in the period since the last interview, but before the past 12 months (data not shown). This proportion varied from 75.5% of those who were asymptomatic risk drinkers in the 12 months preceding the Wave 1 interview to

Table 1. Type of Remission at Baseline[a] for the Wave 1 Sample and for Those Reinterviewed at Wave 2: Individuals in Remission From DSM-IV Alcohol Dependence at Baseline[a]

	Wave 1 sample	Wave 2 reinterview sample
Type of remission	% Distribution at baseline[a]	% Distribution at baseline[a]
Asymptomatic risk drinker	24.8 (1.1)	25.1 (1.1)
Low-risk drinker	36.8 (1.3)	38.4 (1.4)
Abstainer	38.4 (1.3)	36.5 (1.4)
Total	100.0 (0.0)	100.0 (0.0)
No. of cases	2,109	1,772

Source: Dawson et al., 2005.
[a] In the year immediately preceding the Wave 1 interview.

Table 2. Percentage Distribution by Wave 2 Past-Year Recovery Status, According to Type of Remission at Baseline[a]: Individuals in Remission From DSM-IV Alcohol Dependence at Baseline[a]

Baseline recovery status[a]	No. of cases	Wave 2 past-year recovery status				
		Dependent	Partial remission	Asymptomatic risk drinker	Low-risk drinker	Abstainer
Asymptomatic risk drinker	431	6.0 (1.1)	33.9 (2.6)	31.3 (2.6)	21.4 (2.6)	7.4 (1.7)
Low-risk drinker	645	2.9 (0.6)	19.2 (1.8)	11.3 (1.4)	48.3 (2.4)	18.3 (1.9)
Abstainer	696	2.1 (0.6)	3.8 (0.9)	3.4 (1.0)	13.5 (1.7)	77.2 (2.1)

[a]In the year immediately preceding the Wave 1 interview.

84.1% of those who were low-risk drinkers and 94.3% of those who were abstainers ($\chi^2 = 62.8$, df = 2, $p < 0.001$). Thus, stability *within* the follow-up period was also greatest among abstainers.

As can be seen in Table 3, one-quarter (25.9%) of the individuals in full remission from alcohol dependence at Wave 1 had experienced the recurrence of AUD symptoms in at least 1 of the 2 time periods between the Wave 1 and Wave 2 interviews. This proportion decreased from 51.0% of those who were asymptomatic risk drinkers to 27.2% of those who were low-risk drinkers and 7.3% of baseline abstainers. The proportion positive for the recurrence of AUD symptoms also varied according to duration of remission at baseline, declining steadily from 32.7% of those who had been in remission for less than 5 years at baseline to 16.9% of those who had been in remission for 20 years or longer. The association between type of baseline remission and the risk of recurrence of AUD symptoms increased in magnitude and significance with duration of remission at baseline. There was no significant difference in the likelihood of recurrence of AUD symptoms between low-risk drinkers and abstainers among individuals who had been in remission for less than 5 years at baseline, nor between asymptomatic risk drinkers and low-risk drinkers among those who had been in remission for 5 to 9 years.

Only 5.1% of the individuals in full remission at baseline had experienced the recurrence of DSM-IV alcohol dependence between the Wave 1 and Wave 2 interviews (Table 3). As with the recurrence of any AUD symptoms, the recurrence of dependence was inversely associated with the duration of remission at baseline and was highest among persons who were asymptomatic risk drinkers. Unlike the recurrence of any AUD symptoms, though, the overall rates of recurrent dependence did not differ between low-risk drinkers and abstainers (4.0 vs. 2.9%). In fact, even the excess risk of recurrence associated with asymptomatic risk drinking lacked statistical significance in most of the duration categories.

Table 4 presents the reduced logistic regression models used to estimate the association between type of baseline remission and the likelihood of subsequent relapse after adjusting for potential confounders. These include both a main effects model and a model including significant first-order interactions with type of remission for each of the 2 outcomes. Of the wide range of baseline measures considered as potential correlates of relapse, many of which demonstrated significant

Table 3. Proportion of Individuals Formerly in Remission From DSM-IV Alcohol Dependence Who Had Experienced Any Recurrence of AUD Symptoms and Any Recurrence of DSM-IV Alcohol Dependence Between Wave 1 and Wave 2 Interviews, by Type of Remission and Duration of Remission at Baseline

Duration of remission at baseline	No. of cases	Type of remission at baseline			
		Total	Asymptomatic risk drinker	Low-risk drinker	Abstainer
Any recurrence of AUD symptoms:					
All durations[a]	1,772	25.9 (1.2)	51.0 (3.0)	27.2 (2.0)[b]	7.3 (1.1)[b,c]
0–4 years	313	32.7 (3.4)	56.2 (6.5)	28.3 (5.1)[b]	17.0 (3.8)[b]
5–9 years	367	31.2 (3.3)	44.8 (6.0)	37.8 (5.4)	9.6 (3.5)[b,c]
10–14 years	370	23.1 (2.3)	51.4 (6.8)	29.2 (4.6)[b]	7.3 (2.0)[b,c]
15–19 years	279	23.2 (3.0)	47.9 (7.2)	25.6 (0.7)[b]	0.7 (0.7)[b,c]
20+ years	383	16.9 (2.3)	51.8 (7.6)	18.4 (3.7)[b]	1.0 (0.9)[b,c]
Any recurrence of DSM-IV alcohol dependence:					
All durations[a]	1,772	5.1 (0.6)	10.2 (1.9)	4.0 (0.8)[b]	2.9 (0.7)[b]
0–4 years	313	9.0 (2.0)	10.7 (3.5)	8.5 (3.1)	8.0 (2.7)
5–9 years	367	6.5 (1.8)	11.4 (5.2)	6.7 (2.2)	1.5 (1.1)[c]
10–14 years	370	5.2 (1.3)	12.4 (4.5)	2.6 (1.6)[b]	4.0 (1.7)
15–19 years	279	3.1 (1.0)	8.6 (3.7)	2.2 (1.0)	0.0 (0.0)[b,c]
20 + years	383	1.7 (0.7)	5.7 (3.0)	1.8 (1.1)	0.0 (0.0)

AUD, alcohol use disorder.
[a]Including unknown duration of remission.
[b]Percentage is significant than percentage for asymptomatic risk drinkers.
[c]Percentage is significant than percentage for low-risk drinkers.

Table 4. Parameters From Reduced Multiple Logistic Regression Models Predicting Any Recurrence of AUD Symptoms and Any Recurrence of DSM-IV Alcohol Dependence Between Wave 1 and Wave 2: Individuals Who Were in Full Remission From DSM-IV Alcohol Dependence at Baseline

	Model predicting any recurrence of AUD symptoms			Model predicting any recurrence of DSM-IV alcohol dependence		
	Beta	SE	*p*	Beta	SE	*p*
Main effects models						
Intercept	−1.838	0.397	.000	−2.752	0.755	.000
Baseline remission status						
Asymptomatic risk drinker	2.680	0.228	.000	1.951	0.359	.000
Low-risk drinker	1.756	0.221	.000	1.086	0.389	.007
Abstainer (referent)	0.000	0.000	—	0.000	0.000	—
Age at baseline[a]	−0.027	0.007	.000	−0.029	0.013	.025
Past-year smoker at baseline	0.340	0.145	.022	0.879	0.280	.003
Treatment history at baseline	0.567	0.175	.002	0.910	0.297	.003
No. of prior-to-past-year AUD symptoms at baseline	ns	ns	ns	0.055	0.020	.008
Goodness of fit statistics	−2 log-l chi sq = 322.4, df = 5, $p < .001$, Wald $F = 41.2$, df = 560, $p < .001$, $R^2 = .166$			−2 log-l chi sq = 90.8, df = 6, $p < .001$, Wald $F = 11.9$, df = 660, $p < .001$, $R^2 = .050$		
Models containing age interactions						
Intercept	1.167	0.663	.083	−0.289	1.141	.801
Baseline remission status						
Asymptomatic risk drinker	−1.341	0.773	.088	−1.775	1.318	.183
Low-risk drinker	−1.121	0.796	.135	−2.288	1.354	.096
Abstainer (referent)	0.000	0.000	—	0.000	0.000	—
Age at baseline[a]	−0.102	0.016	.000	−0.103	0.027	.000
Past-year smoker at baseline	0.383	0.141	.009	−0.924	0.276	.001
Treatment history at baseline	0.588	0.176	.000	0.899	0.284	.002
No. of prior-to-past-year AUD symptoms at baseline	ns	ns	ns	0.056	0.019	.005
Interaction of age at baseline[a] with baseline remission status						
Asymptomatic risk drinker	0.101	0.018	.000	0.093	0.032	.006
Low-risk drinker	0.073	0.019	.000	0.083	0.033	.014
Abstainer (referent)	0.000	0.000	—	0.000	0.000	—
Goodness of fit statistics	−2 log-l chi sq = 351.8, df = 7, $p < .001$, Wald F = 31.8, df = 760, $p < .001$, $R^2 = .180$			−2 log-l chi sq = 100.3, df = 8, $p < .001$, Wald F = 12.1, df = 860, $p < .001$, $R^2 = .055$		

AUD, alcohol use disorder;−2 log-l chi sq, −2 log-likelihood chi square.

Factors removed from all models due to lack of significance included gender, race/ethnicity, marital status, college education, family history of alcoholism, early initiation of drinking, duration from first drink to dependence, duration of dependence, duration of remission, and history of previous relapse, all measured as of baseline.

[a]To improve model fit, ages >55 years were truncated to 55 years.

bivariate associations with the outcomes (data not shown), only a few yielded significant net associations in these multivariate models. In addition to type of remission, these included age (negatively associated with the odds of relapse), history of obtaining help for alcohol problems and smoking (each positively associated with the odds of relapse), and number of AUD symptoms (positively associated with recurrence of dependence but not with the recurrence of any AUD symptoms). Based on the main effects model, the odds of having experienced any recurrence of AUD symptoms between Wave 1 and Wave 2 were nearly 15 times as high for asymptomatic risk drinkers as for abstainers, OR = $e^{2.680}$ = 14.6 (95% CI = 9.2–23.0) and nearly 6 times as high for low-risk drinkers, OR = $e^{1.756}$ = 5.8 (95% CI = 3.7–9.0). For the recurrence of DSM-IV alcohol dependence, the OR for asymptomatic risk drinkers and low-risk drinkers relative to abstainers were $e^{1.951}$ = 7.0 (95% CI = 3.4–14.4) and $e^{1.086}$ = 3.0 (95% CI = 1.4–6.5), respectively.

The only significant first-order interactions were between type of remission and age at baseline. These positive interactions indicate that the excess risks of relapse associated with asymptomatic risk drinking and low-risk drinking increased with age. Figure 1 illustrates the impact of age on the OR for recurrence of any AUD symptoms, using broad age categories for ease of presentation. The OR for asymptomatic risk drinkers relative to abstainers increased from 3.3 at ages 18 to 24 years to 87.8 at ages 55 years and older, but the OR were statistically significant (i.e., the odds of relapse were significantly different from those for abstainers) only among individuals 25 years of age and older. The OR for low-risk drinkers, which varied from 2.9 to 32.9, were significant only at ages 35 and older. For the recurrence of DSM-IV alcohol dependence (Fig. 2), the OR for asymptomatic risk drinkers relative to abstainers increased from 0.9 at ages 18 to 24 years to 36.0 at ages 55 years and older, but were statistically significant only among individuals aged 35 years and older. The OR for low-risk drinkers, which varied from 0.3 to 5.5, were significant only at ages 45 years and older.

To examine whether type of remission might mediate associations between relapse and measures representing the 3 factors of the conceptual framework proposed by Delucchi et al. (2004, 2007), the models predicting recurrence of symptoms

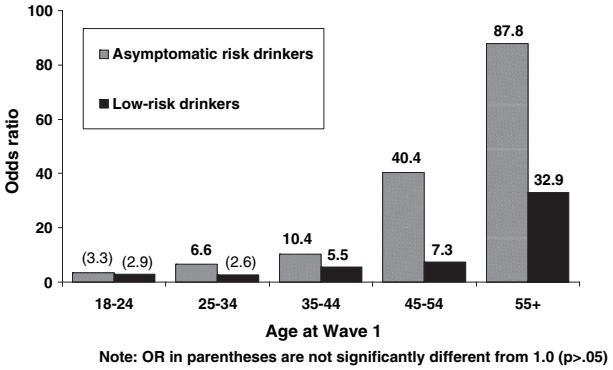

Fig. 1. Odds ratios for any recurrence of alcohol use disorder (AUD) symptoms for asymptomatic risk drinkers and low-risk drinkers relative to abstainers.

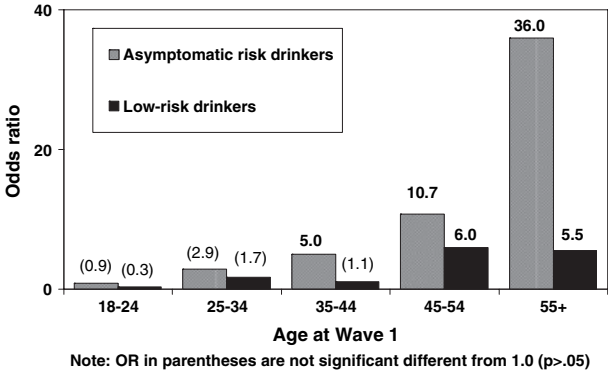

Fig. 2. Odds ratios for any recurrence of DSM-IV dependence for asymptomatic risk drinkers and low-risk drinkers relative to abstainers.

and dependence were rerun excluding type of remission as a predictor. In its absence, treatment no longer was significantly associated with either outcome, the protective effect of age was significantly increased in magnitude, and the excess risk associated with smoking showed a nonsignificant increase in magnitude. In addition, 2 severity measures—history of prior relapse and number of symptoms of dependence—took on significant, positive associations with recurrence of any AUD symptoms (data not shown).

DISCUSSION

This paper presents the first nationally representative data on the stability of remission from DSM-IV alcohol dependence in the general population of the United States, including the first nationally representative estimates of rates of relapse among remitted alcoholics. Over a 3-year follow-up period, one-quarter (25.9%) experienced the recurrence of AUD symptoms and 1 in 20 (5.1%) experienced the recurrence of dependence. The estimated recurrence of dependence is lower than what was observed in a comparable study conducted in the Netherlands (13.6%), but the Dutch estimate (De Bruijn et al., 2006) was based on so few cases that the difference between the 2 estimates lies within sampling error. Comparisons with other studies are precluded by differences in the populations studied and the definition of relapse, but the lower rates of relapse compared with treatment samples are predictable, given the greater severity and comorbidity of dependence among those entering treatment.

The findings of this study were not inconsistent with our initial hypotheses, but neither did they fully support them. We had hypothesized that the risk of relapse would be greater for low-risk drinkers than abstainers and greatest of all for asymptomatic risk drinkers. This was true in the aggregate (i.e., when considering all ages combined), and it was true for middle-aged and older adults. Among most recovering alcoholics, abstinent recovery was clearly associated with a more favorable course, i.e., with a lower rate of relapse, than nonabstinent recovery, and risk drinking increased the likelihood of relapse relative to low-risk drinking. However, the benefits of abstinent recovery did not extend to younger individuals. There was no increased likelihood of recurrent AUD symptoms for low-risk drinkers relative to abstainers among those who were 18 to 34 years of age at baseline, and there was no increased likelihood for asymptomatic risk drinkers among those who were aged 18 to 24 years at baseline. For the recurrence of DSM-IV alcohol dependence, the lack of association with type of remission extended to even older ages.

This lack of association between type of remission and relapse among younger alcoholics can be interpreted in a number of ways. First, one might argue that the findings provide evidence that moderate-drinking goals represent a viable pathway to recovery among the young, possibly because they have not yet developed the rapid reinstatement of craving that would lead to excessive consumption and recurrence of alcohol problems. However, this interpretation ignores the fact that relapse rates were greatest for the young, regardless of type of remission. That is, the lack of association between relapse and type of remission among the young does not so much reflect equally good outcomes for the drinkers as equally poor outcomes for the abstainers. Why might this be the case? Perhaps it reflects the difficulty of finding sober social networks at ages when drinking, even heavy drinking, is the norm. Perhaps the younger abstainers were less likely to have voluntarily chosen abstinence as their mode of recovery (e.g., more likely to have become abstinent in response to legal requirements following a drunk driving or other legal offense) and consequently less committed to remaining abstinent. Possibly their initial dependence symptoms were mild enough in nature to make them think that they could safely resume drinking. The younger alcoholics in this sample were significantly less likely those aged 25 years and older at baseline to have endorsed the dependence criterion of impaired control (data not shown), possibly because they had not previously attempted to control their drinking and thought they could do so successfully. Whatever their cause, the extremely high rates of relapse among baseline abstainers aged 18 to 24 years—29.2% for recurrence of any AUD symptoms and 11.7% for recurrence of dependence compared with 6.5 and 2.7 for older abstainers—warrant further investigation, and

signal a major challenge that needs to be addressed in treatment and prevention programs, in the legal system, and on college campuses.

We also had hypothesized that individuals with a longer duration of remission at baseline would be less likely to relapse. Although there was indeed a significant negative association between duration of remission and relapse at the bivariate level, this association fell just short of significance in the multivariate models. Thus, the apparent protective effect of a longer duration of remission probably reflects the fact that those with longer durations were older and more likely to be abstainers—both factors independently associated with a reduced risk of relapse.

The treatment literature offers widespread evidence that mood disorders, especially major depression, are associated with increased risk of AUD relapse, in addition to conflicting findings regarding the impact of anxiety and personality disorders (see review in Bradizza et al., 2006). In this general population sample, the odds of relapse were not significantly associated with any of these types of baseline disorder, although the presence of a personality disorder had been negatively associated with the initial likelihood of having achieved recovery at Wave 1 (Dawson et al., 2005). More research is needed to clarify whether the apparently stronger adverse effect of dual diagnosis on AUD recovery in treatment samples is a function of the relative severity of the comorbid psychiatric disorders in the 2 populations or a function of some aspect of treatment for dual disorders. Another possibility is that the treatment literature may not have consistently controlled for smoking status in examining the impact of comorbid conditions on alcoholic relapse. In the general population, tobacco use has a strong positive association with mood, anxiety and personality disorders (Breslau, 1995; Grant et al., 2004), and smoking emerged as one of the few significant correlates of relapse in this analysis.

The alcohol literature offers mixed evidence as to whether smoking cessation improves or detracts from the course of alcohol recovery and vice versa (see review in Friend and Pagano, 2005). Few studies have examined whether baseline smoking status, per se, is associated with the risk of relapse, but those that have done so generally have not found a significant association (e.g., Gulliver et al., 2000; Schmidt and Smolka, 2001). The fact that this study found a positive association between baseline smoking and the risk of relapse may result from greater statistical power because of its larger sample size. The association could reflect direct effects of smoking, e.g., as a behavior that cues the desire to drink, or it might merely reflect selectivity, with baseline smoking acting as a marker of a general inability to give up addictive substance use. Supporting the interpretation of selectivity, when baseline smokers were divided into those who did and did not continue to smoke through Wave 2, the association between smoking and relapse was significant only for those who continued smoking (data not shown).

The finding that having obtained help for alcohol problems was associated with an increased likelihood of relapse is consistent with the fact that individuals who had obtained help had a higher rate of prior relapse at baseline, 36.3 compared with 26.0% for those who had not sought help (Dawson et al., 2006). Although the measure of obtaining help for alcohol problems that was used in this analysis excluded help obtained postbaseline, i.e., between Waves 1 and 2, inclusion of more recent treatment/12-step participation did not diminish the association of this measure with relapse. In fact, all of the individuals who obtained help for their alcohol problems between the 2 waves ($n = 33$) had experienced the recurrence of alcohol symptoms and the majority had experienced the recurrence of dependence (data not shown). Our data do not indicate whether the postbaseline treatment/12-step participation preceded or occurred in response to the recurrence of alcohol problems.

The positive association between history of obtaining help for alcohol problems and relapse should not be interpreted as evidence that formal treatment and participation in 12-step programs are ineffective or counterproductive in achieving or maintaining remission from AUDs. First, it is worth noting that there was no association between treatment and relapse in the models that excluded type of remission as predictors. That is, the positive association of treatment with abstinent recovery, which had a better prognosis than nonabstinent recovery or risk drinking, offset the apparent adverse impact of treatment within type of remission. Second, seeking help for alcohol problems typically occurs in response to sustained problems with independently achieving or maintaining sobriety. In a previous study of the role of treatment in achieving recovery from AUD, we demonstrated that when individuals who obtained help at a given interval postonset of dependence were compared with others who were still dependent after an equally long interval, those who obtained help were significantly more likely to subsequently achieve recovery (Dawson et al., 2006). The true impact of obtaining help could only be assessed by means of time-varying survival models that did not count individuals as positive for obtaining help until help was first obtained. Such models were inappropriate for the present analysis because of the short 3-year time frame and the fact that most treatment/12-step participation began prior to this period.

Despite the lack of association between relapse and most of the measures we examined representing the factors of individual characteristics, formal treatment and informal support, there was no evidence that type of remission played a mediating role. Most of these factors still failed to show a significant association with either definition of relapse, even after excluding type of remission from the models. The only exceptions were 2 severity measures that became significant correlates of the recurrence of AUD symptoms after removing controls for type of remission. Even when type of remission was included as a predictor, the models used in this analysis explained only a small part of the variance in the recurrence of AUD symptoms and of dependence. In part, this may reflect the fact that 3 years is a short and arbitrary time period in the recovery process, a period that occurred well after remission began for

some of the individuals who were examined in this analysis and in the early stages of recovery for others. Many factors associated with achieving and maintaining recovery may have been subsumed by the controls for age and interval since onset of remission. Alternatively, this may indicate the importance of examining measures not addressed in this analysis, such as social networks (both those promoting and impeding sobriety), stressors and coping mechanisms, or it may indicate potential advantages of a prospective design in which there is a common starting point, e.g., immediately after achievement of remission, for all individuals studied.

Because this analysis concerns events that occurred within a narrow 3-year time span, the usual limitation of recall error should be less serious than in surveys with a longer period of retrospective recall. As with any longitudinal study, the impact of censoring (individuals being withdrawn from observation because of death, institutionalization or other reasons for nonresponse) must be considered. If individuals who died, became institutionalized or did not choose to be reinterviewed were disproportionately likely to have relapsed, as one might suspect, then our relapse rates would underestimate the true prospective probability of relapse among remitted alcoholics. Alternatively, if they were less likely to have relapsed, then our relapse rates would overestimate the true probability of relapse. Although the short length and lack of variability in the follow-up interval limit the potential bias that might be associated with censoring of data, the results of this study should be interpreted with appropriate caution as to the possible implications of selective survival and nonresponse.

Despite this concern, these data represent the largest longitudinal study to date of individuals with alcohol dependence in the U.S. general population, and they provide new and valuable information on both the course of recovery from alcoholism and the likelihood and correlates of relapse. In particular, they highlight the need for better approaches to enabling and maintaining recovery among young adults in remission from alcohol dependence—a highly vulnerable subgroup composed of individuals who may lack the social and personal resources that help older adults to be more successful in avoiding relapse.

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