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CORRELATES OF RECOVERY FROM ALCOHOL DEPENDENCE: A PROSPECTIVE STUDY OVER A 3-YEAR FOLLOW-UP INTERVAL

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Abstract

Background—Correlates of recovery from alcohol dependence have been identified through a variety of study designs characterized by different strengths and limitations. The goal of this study was to compare correlates of recovery based on a 3-year prospective design with those based on cross-sectional analyses of data from the same source.

Methods—Data from the 2001–2002 Wave 1 and 2004–2005 Wave 2 National Epidemiologic Survey on Alcohol and Related Conditions (NESARC) were used to examine baseline characteristics associated with Wave 2 recovery from alcohol dependence, among those who classified with past-year DSM-IV alcohol dependence at Wave 1 (n=1,172).

Results—Abstinent recovery (AR) was significantly associated with Black/Asian/Hispanic race/ethnicity, children <1 year of age in the household at baseline, attending religious services weekly at follow-up, and having initiated help seeking that comprised/included 12-step participation within <3 years prior to baseline. Nonabstinent recovery (NR) was positively associated with being never married at baseline, having job problems or being unemployed in the year preceding baseline, attending religious services <weekly at follow-up, baseline smoking and volume of ethanol intake and having terminated a first marriage within <3 years prior to baseline. Findings, including others of marginal significance ($.05 < p < .10$) generally supported results from prior pseudo-prospective survival analyses with time-dependent covariates but differed in many ways from cross-sectional analyses of Wave 1 NESARC.

Conclusions—Various aspects of study design must be considered when interpreting correlates of recovery. Cross-sectional analyses of lifetime correlates of recovery are highly subject to misinterpretation, but pseudo-prospective survival analyses with time-dependent covariates may yield results as valid as those from prospective studies.

Keywords

alcohol dependence; abstinent recovery; nonabstinent recovery; study design; prospective

INTRODUCTION

Correlates of recovery from alcohol dependence have been identified through multiple study designs characterized by different strengths and limitations. Treatment studies represent only individuals who enter the treatment system, comprising just one quarter to one half of those with lifetime dependence in the United States and Canada (Dawson et al., 2005; Cunningham and Breslin, 2004). Not only are these individuals selected for severity of dependence, but there is contradictory evidence as to whether they differ from untreated individuals on correlates of recovery [Dawson et al., 2005, 2006a; Blomqvist 2002; Cunningham et al., 2000; Matzger et al., 2005; Moos and Moos, 2005; Moos et al., 2006; Sobell et al., 1996; Timko et al., 2000; Tuckett, 1995]. Treatment studies also may exclude individuals who have participated in 12-step or other mutual help groups without formal treatment.

Studies of natural recovery (Klingemann et al., 2009; Sobell et al., 2000) exclude individuals who have accessed formal treatment, although varying in how strictly treatment is defined (Bischof et al., 2002). Many are based on media-solicited samples of debatable generalizability (Rumpf et al., 2000). Those based solely on recovered individuals can identify factors that discriminate between abstinent recovery (AR) and nonabstinent recovery (NR), but not factors associated with the overall likelihood of recovery. Even those that include nonrecovered individuals (Bischof et al., 2001, 2003) ignore the role of treatment in recovery.

General population samples provide recovery data for all alcohol dependent individuals, but most are cross-sectional. Although retrospectively ascertained cross-sectional data can identify fixed characteristics associated with recovery, e.g., sex, they preclude inferring causality for factors whose values vary over the life course. When the timing of these factors can be established, this limitation can be overcome through the use of pseudo-prospective time-dependent survival models. Using this approach, a study based on the 2001-2002 National Epidemiologic Survey on Alcohol and Related Conditions (NESARC) showed that the likelihood of AR and NR increased after the initiation of alcohol treatment or 12-step participation (Dawson et al., 2006a). A similar study demonstrated that both initiating and terminating a first marriage increased the odds of NR within the first three years following these events, after which point those still dependent had a reduced likelihood of subsequent NR. The likelihood of AR was increased in the first three years after becoming a parent for the first time (Dawson et al., 2006b). Other examples of pseudo-prospective approaches utilizing general population samples include a study in which past-year treatment was associated with a 10% increase in past month abstinence and binge-free drinking (Cunningham, 2005). Despite their strengths, time-dependent survival models are susceptible to bias. The salience of factors may differ for recovered and unrecovered individuals, resulting in differential recall and detection bias, and errors in recalling dates may affect the ordering of events and thus their associations with recovery.

Prospective studies of recovery in general population samples, arguably the least susceptible to recall and detection bias, are rare. One such study was the NESARC, in which Wave 1 respondents interviewed in 2001-2002 were reinterviewed in 2004-2005. In a recent study of individuals with Wave 1 past-year alcohol dependence, the proportion still dependent at the three-year Wave 2 follow-up was highest for the chronic severe subtype, characterized by elevated familial alcoholism, psychopathology and other substance use and substance use disorders (SUD) at baseline. However, there were no significant differences among subtypes in the proportions who had achieved AR or NR by Wave 2 (Moss et al., 2010). In a long-term follow-up study of middle-aged community residents, female gender, shorter duration of alcohol problems, fewer and less severe symptoms, lower volume and frequency of

consumption and lower peer approval of drinking were positively associated with remission of alcohol problems. Individuals with stable AR had more alcohol problems, higher rates of depression, lower incomes and more financial stress at baseline and were more likely to have accessed formal treatment and Alcoholics Anonymous than those with NR (Schutte et al., 2001, 2006). However, this sample provided no information on correlates of recovery in the younger age groups where alcohol dependence is most prevalent (Grant et al., 2004a), nor was it a representative population sample. Moreover, the baseline measure of alcohol problems did not constitute a formal diagnosis of alcohol dependence.

Among other prospective studies of general population/community samples, Edens et al. (2008) found that women positive for AUD during both waves of the Epidemiological Catchment Area study in St. Louis were more likely than men to be dependent at the 14-year follow-up. The San Diego Prospective Study found that sustained remission from AUD at the 25-year follow-up was associated with lower drinking frequencies at years 1 and 10 and being divorced/separated at year 10 (Schuckit and Smith, 2011).

In summary, correlates of recovery from alcohol dependence in general population samples show wide variation, reflecting differences in study design (cross-sectional vs. prospective), study population (individuals with lifetime vs. past-year dependence), the time frame over which recovery is assessed (from first onset of dependence vs. from date of interview), sample characteristics (as influenced by inclusion criteria and attrition), and the range of potential correlates considered. In an attempt to address this lack of consensus, the present paper has two broad aims. The first is to augment the scant data on prospective correlates of recovery from alcohol dependence by examining recovery over a 3-year follow-up interval, using two waves of data from a nationally representative sample of U.S. adults. The second is to compare our findings with prior analyses of lifetime data collected in the first wave of interviews with the same sample, speculating on how differences in the factors noted above may have contributed to discrepant findings.

METHODS

Sample

This study used data from both waves of the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC). The nationally representative 2001-2002 Wave 1 sample contained 43,093 U.S. adults 18 and older living in households and noninstitutional group quarters (response rate = 81.0%). The 2004-2005 Wave 2 follow-up sample contained 34,653 of the original respondents, 86.7% of those eligible for reinterview, for a cumulative response rate of 70.2%. Detailed information on the sample design and weighting are available elsewhere (Grant et al., 2003a, 2007, 2009). All potential respondents were informed in writing about the nature of the survey, uses of the survey data, voluntary nature of their participation and legally-mandated confidentiality of identifiable survey information. The research protocol received full ethical review and approval from the U.S. Census Bureau and the U.S. Office of Management and Budget.

This analysis is based on a subsample of Wave 1 NESARC respondents classified with past-year alcohol dependence at baseline, i.e., who endorsed at least three of the seven DSM-IV (American Psychiatric Association, 1994) dependence criteria for the 12 months preceding the Wave 1 interview ($n=1,484$), and it was further restricted to those who were reinterviewed at Wave 2 ($n=1,172$). Alcohol dependence was assessed using the Alcohol Use Disorders and Associated Disability Interview Schedule – DSM-IV Version (AUDADIS-IV, Grant et al., 2001) and exhibited a good level of reliability, $\kappa = 0.74$ (Grant et al., 2003b).

The results of this analysis are compared with several earlier NESARC-based studies (Dawson et al., 2005, 2006a, 2006b) that assessed recovery status in the year immediately preceding the Wave 1 NESARC among Wave 1 respondents with a prior-to-past-year (PPY) onset of DSM-IV alcohol dependence (n=4,422). Of these, those who were still classified as dependent in the year immediately preceding the Wave 1 interview and who were reinterviewed at Wave 2 (n=873) are included in the sample for the current analysis, with the remainder of the current sample (n=299) reflecting individuals with a past-year Wave 1 onset of dependence.

Measures

Recovery from alcohol dependence—Recovery was determined for the 12 months preceding the Wave 2 NESARC follow-up interview. Individuals were positive for abstinent recovery (AR) if they did not consume any alcohol during this period. They were positive for nonabstinent recovery (NR) if they consumed alcohol but a) did not endorse any Wave 2 past-year DSM-IV alcohol dependence or abuse symptoms or severe headaches when getting over drinking (not a DSM-IV withdrawal symptom but considered contraindicative of recovery in prior NESARC analyses) and b) did not exceed the NIAAA low-risk drinking limits (NIAAA, 2005, 2009): for men, 14 drinks per week on average and 4 drinks on any day; for women, 7 drinks per week on average and 3 drinks on any day. Average number of weekly drinks was calculated from multiple questions on quantity and frequency of drinking (Dawson, 2003). Maximum number of drinks consumed on any day in the past year was asked directly.

Correlates of recovery—Potential correlates of recovery were measured as of the year preceding the baseline Wave 1 interview unless otherwise noted. Marital status, parenthood, education and employment were coded using two different sets of variables roughly analogous to those used in prior analyses (Dawson et al., 2005, 2006b). In the first set, dummy variables for marital status consisted of divorced/separated and never married (referent = married, cohabiting or widowed); having an infant <1 year of age in the household was based on household screening data; education was dichotomized as having attended college versus not; and employment (any full- or part-time work in the year preceding baseline) distinguished individuals who reported job problems (fired or laid off, unemployed and looking for work for >1 month, troubles with a boss or coworker) from those who did not (referent = did not work in past year). In the second set, ages at initiation and termination of first marriage, birth/arrival of first child, completion of highest level of schooling and start of first full-time job yielded pairs of dummy variables that measured whether these events occurred <3 years prior to baseline or 3+ years prior to baseline (referent = did not occur prior to baseline).

Religiosity and spirituality were measured in the Wave 2 NESARC. Although the direction of causality thus cannot be inferred, these measures were examined because of their strong associations with substance use, SUD and recovery in the literature (e.g., Kelly et al., 2010; Koenig and Vaillant, 2009; Miller 1998; Prescott et al., 1997; Robinson et al., 2007; Zeng, 2007). Religiosity refers to frequency of attendance at religious services, whereas spirituality measures the importance of religious and spiritual beliefs in daily life.

Number of past-year medical conditions was based on a list of 11 chronic and acute conditions. Respondents had to report that their diagnosis had been confirmed by a health professional. Past-year health insurance coverage distinguished private insurance (obtained by the individual or provided a current or prior employer, including the military) from public insurance (Medicare, Medicaid) (referent = no coverage). Past-year mood disorder and anxiety disorder conformed to DSM-IV criteria, as did lifetime personality disorder. The

derivation, reliability and validity of these diagnoses have been described in detail elsewhere (Grant et al., 2004b, 2004c; Hasin et al., 2007; Pulay et al., 2010). Past-year smokers comprised individuals who used any of five types of tobacco, and past-year drug users comprised those who reported illicit use any of 10 types of drugs, distinguishing those who did and did not satisfy the DSM-IV criteria for a drug use disorder (DUD) (Stinson et al., 2005).

Age at first drink excluded small sips or tastes. Past-year volume of ethanol intake (Dawson, 2003) was set to the larger of the sum of four beverage-specific volumes or the volume for all beverage types combined. Interval since onset of dependence is the difference between age at baseline and age at first onset of dependence. Severity of dependence as represented by number of Wave 1 past-year AUD symptoms reflected positively endorsed items out of a list of 34 that included severe headaches following drinking or when trying to cut down. Number of episodes of dependence was used to identify individuals with prior episodes of dependence.

Individuals who reported seeking help for their drinking problems were asked whether they had accessed 13 different sources of assistance and when they first got help. Based on prior evidence that the effect of help-seeking varied by source and timing (Dawson et al., 2006a), a five-level variable was constructed: 1) initiated help-seeking, including 12-step, within past 3 years; 2) initiated help-seeking, excluding 12-step, within past 3 years; 3) initiated help-seeking, including 12-step, 3+ years ago; 4) initiated help-seeking, excluding 12-step, 3+ years ago; and 5) no help-seeking prior to baseline.

Analysis—Chi-square tests assessed bivariate associations with recovery. Multiple logistic regression models estimated the odds of AR (excluding individuals with NR) and the odds of NR (excluding those with AR). Because of the large number of candidate correlates, those with bivariate p-values $>.500$ were excluded from the initial models. Each model was manually reduced to retain only those correlates with p-values $<.10$ or whose removal would change the referent category for nominal variables. Thus, if any category of a multicategorical variable had a p-value $<.10$, all categories were retained in the reduced models. Covariates with marginal levels of significance ($.05 - <.10$) were retained for comparisons with prior analyses but are not considered as definitive indicators of associations in their own right. Past-year average daily ethanol intake (log ounces) and number of AUD symptoms were categorized for presenting bivariate associations but treated as continuous in the multivariate models. Statistical analyses employed SUDAAN (Research Triangle Institute, 2008), a software package that uses Taylor-series linearization to yield variance estimates that account for complex, multi-stage sample designs.

RESULTS

Among individuals classified with baseline past-year alcohol dependence, 5.4% were positive for AR and 5.5% were positive for NR in the year preceding the 3-year follow-up interview (Table 1). The few potential correlates of recovery that had significant ($p<.05$) bivariate associations with recovery were marital status (highest rates of recovery among the divorced and separated, $p=.009$), recent initiation of first marriage (positively associated with NR, $p=.044$), employment status (job problems negatively associated with AR; job problems and unemployment positively associated with NR, $p=.005$), religiosity (AR positively associated with frequency of religious service attendance; rates of NR highest at intermediate frequencies, $p=.016$), smoking (negatively associated with AR and NR, $p=.008$), illicit DUD (negatively associated with NR, $p=.006$) and number of past-year AUD symptoms (highest levels of AR at highest severity levels; highest rates of NR at moderate severity levels, $p=.045$).

Table 2 shows the full and reduced multiple logistic regression models predicting AR and NR. In the reduced model, the odds of AR were doubled ($OR = e^{0.695} = 2.00$, $p = .028$) among individuals of Black, Asian or Hispanic race/ethnicity and nearly quadrupled ($OR = 3.77$, $p = .037$) among those with children <1 year of age in the household. Compared to individuals who did not attend religious services at Wave 2, those who did so once a week were 2.62 times as likely to have achieved AR ($p = .019$). Finally, the odds of AR among individuals who had initiated help-seeking that consisted of or included 12-step participation <3 years prior to baseline were nine times greater than those for individuals with no help-seeking at baseline ($OR = 9.00$, $p < .001$). Other factors suggestive/supportive of associations with AR included being divorced or separated ($OR = 2.03$, $p = .078$), having been employed with job problems ($OR = 0.54$, $p = .094$), smoking ($OR = 0.56$, $p = .073$) and number of AUD symptoms ($OR = 1.04$, $p = .095$).

The odds of NR in the reduced model were significantly decreased by being never married ($OR = 0.41$, $p = .014$) and increased by both past-year work problems ($OR = 5.19$, $p < .001$) and not having worked in the past year ($OR = 3.82$, $p = .002$). Attendance at religious services <1 week (vs. not at all) was associated with three-fold increase in the odds of NR ($OR = 3.00$, $p = .001$), whereas smoking reduced the odds of NR ($OR = 0.42$, $p = .014$). The odds of NR also were negatively associated with volume of ethanol consumption, $p = .001$. In addition, being divorced or separated ($OR = 2.08$, $p = .083$) and having a child <1 in the household ($OR = 4.03$, $p = .072$) showed marginal positive associations with NR, whereas having a past-year DUD ($OR = 0.28$, $p = .058$) showed a marginal negative association. A final marginal association involved the odds of NR being decreased among individuals with one medical problem ($OR = 0.37$, $p = .061$) but increased among those with two or more medical problems ($OR = 2.05$, $p = .051$).

In the models that used the alternative measures of transitional life events (data not shown), having terminated a first marriage <3 years prior to baseline significantly increased the odds of NR ($OR = 4.21$, $p = .018$); the association was of smaller magnitude and marginal statistical significance for AR ($OR = 3.00$, $p = .071$). In addition, having initiated a first marriage <3 years prior to baseline showed a marginal association with NR ($OR = 3.03$, $p = .051$). In the models using these alternative measures, the other model parameters were very similar to those shown in Table 2.

DISCUSSION

This study of factors associated with 3-year prospective recovery from alcohol dependence replicated a number of correlates of recovery identified in earlier studies based on Wave 1 NESARC data. For AR, the current finding of a strong positive impact of recent help-seeking that included 12-step participation was consistent with a prior survival analysis of help-seeking (Dawson et al., 2006a), although it is worth noting that the majority of individuals who achieved both AR and NR in the present study did not access any form of treatment or 12-step participation. An earlier finding of a positive association between severity of dependence and AR obtained in a cross-sectional analysis (Dawson et al., 2005) received support of marginal statistical significance ($p = .095$) in this study. With respect to NR, the current study's finding of positive associations with recent initiation or termination of first marriage supported an earlier survival analysis of major life transitions (Dawson et al., 2006b), albeit at more marginal level of statistical significance for initiation of marriage ($p = .051$), and its finding of a highly significant negative association between volume of consumption and NR replicated earlier cross-sectional findings (Dawson et al., 2005). These consistent findings, obtained despite a smaller sample size and shorter observation period, highlight correlates of AR and NR that are sufficiently robust to replicate under divergent study designs, analytic models, sample restrictions and lengths of follow-up.

This study's finding that AR and NR were equally common outcomes of alcohol dependence after a three-year follow-up also supported an earlier cross-sectional analysis of Wave 1 NESARC data. In that study, the past-year prevalence of AR and NR were 18.2% and 17.7%, respectively, among individuals with an onset of dependence in any prior year (Dawson et al, 2005). The overall higher level of recovery in the earlier study reflects the fact that its longer intervals since first onset provided more time for recovery to have occurred. More than two-thirds of the individuals in the current sample had been dependent for less than five years at baseline, half for less than two years. In contrast, less than one quarter of those in the cross-sectional Wave 1 sample had intervals of less than five years since first onset of dependence. The current study's replication of AR and NR as equally common outcomes underscores the legitimacy of NR as a viable path to recovery for some dependent individuals.

Because many previously identified correlates of recovery were *not* supported by the present analysis, it may be informative to speculate on possible causes of the discrepancies. Many of these occurred relative to an earlier cross-sectional analysis of the Wave 1 NESARC data that examined past-year recovery among those with a prior onset of dependence (Dawson et al., 2005). For example, the earlier study found positive associations of age with AR and of interval since onset of dependence with both AR and NR that were not replicated in the current study. However, the earlier study's measures of age and interval since onset corresponded to the *end* of the observation period over which recovery was retrospectively assessed. Their positive associations simply reflect the increasing cumulative probability of recovery over time. In contrast, identical measures of Wave 1 past-year age and interval since onset corresponded to the *beginning* of the observation period in the current study, by which point older ages and longer intervals represented markers of chronic dependence, implying a poor prognosis for future recovery. Thus, correlates of recovery take on quite different interpretations when measured at the start and the end of the period over which recovery is assessed. Another example of this is the former finding of a positive association between being married and both AR and NR that was not replicated in the current study. In this case, the former study's findings may indicate that individuals who recovered were more likely to have become/remained married than those who did not recover; that is, recovery may have affected marital status rather than vice versa.

Our earlier cross-sectional analysis found that severity of dependence was negatively associated with NR, another finding not replicated in the current study. The significant negative association in the earlier study may result from the outcome measure, type of recovery in the year preceding the Wave 1 interview, not necessarily being the type of recovery first achieved. Within the earlier sample, the increasing ratio of AR to NR over time suggested that some individuals ultimately shifted from NR to AR. If this were disproportionately the case for individuals with severe dependence, who might have the greatest difficulty sustaining moderate drinking, this could have contributed to the previously observed negative association with NR. In the current study, the shorter observation interval of just 3 years likely would have resulted in less switching from NR to AR. The discrepancy also may reflect different measures. The prior study counted lifetime dependence symptoms. The current study included abuse symptoms but measured number of symptoms at baseline, when some lifetime symptoms might not yet have occurred (i.e., those occurring for the first time since the Wave 1 interview) and others might already have remitted. This also may help to explain why the earlier study's strong positive association between severity and AR received only marginal support in the current survey. Similarly, the lack of replication in the current study of a negative association between AR and any PD may reflect the addition of three new PDs first measured in the Wave 2 survey that were included in the current but not the earlier study's definition of any PD.

Unlike the earlier cross-sectional study, the present study found a strong negative association between tobacco use and AR, consistent with prior research supporting the possibility of common genetic or personality factors underlying nicotine and alcohol dependence and the synergistic properties of the concurrent use of alcohol and tobacco (Kerf et al., 1991; Schiffman et al., 1994; Swan et al., 1990; Zachny, 1990). Again, the discrepancy likely reflects different smoking measures. The cross-sectional study used a lifetime smoking measure that included former smokers, who by virtue of having given up one addictive substance may have been at increased likelihood of recovery from alcohol dependence, and current smokers, who by virtue of *not* having given up smoking, may have been at decreased likelihood of recovery. These two effects may have cancelled each other out in the earlier study. Alternatively, given the more recent observation period for the current analysis, the discrepancy may reflect cohort effects or results of recent policy changes restricting venues for smoking.

The earlier cross-sectional analysis found a slightly increased likelihood of AR among women that was not replicated in this study, possibly reflecting this study's adjustment for frequency of attendance at religious services (a positive predictor of AR that was more common among women than men) and past-year smoking (a negative predictor of AR that was less common among women). These factors were not controlled in the earlier study. It could also mean that the excess odds of AR in the previous study reflected a lower tendency for women to relapse from AR as opposed to a greater tendency to achieve AR in the short run, as was measured in the current study. Similarly, the current study's finding of an increased likelihood of AR among Blacks, Hispanics and Asians that was not found in the cross-sectional analysis could mean that members of these race/ethnic groups are more likely to initially achieve AR but no more likely to sustain it. Alternatively, the lack of association in the earlier study may have reflected its slightly different grouping of race/ethnic groups. In the current study, bivariate associations determined the decision to combine Native Americans with non-Hispanic whites to form the reference group against which all others combined were evaluated. In sum, differences between the current study and our earlier cross-sectional study of recovery reflect numerous differences in sample definition, observation period and measurement and indicate the importance of considering these aspects of study design in the interpretation of findings.

Compared to the earlier survival analysis examining the impact of help-seeking (Dawson et al., 2006a), the present study did not replicate the weak positive association of formal treatment only (no 12-step) with both AR and NR. Arguably, when data on recovery and treatment are collected retrospectively, as in the prior analysis, the likelihood of recalling brief sources of formal treatment such as physician advice to stop drinking may be greater among people who thought it contributed to their having achieved recovery. The resulting detection bias might have inflated the positive association between formal treatment and recovery. Participation in 12-step programs, generally more sustained and active in nature, is unlikely to be forgotten regardless of recovery and may be less susceptible to this type of bias. The present study also failed to replicate the earlier positive association between NR and recent help-seeking including 12-step; however it did find a positive association that fell just short of our cutoff for reporting findings of marginal significance ($OR = 2.72, p=.119$).

Whereas another earlier survival analysis of the Wave 1 data (Dawson et al., 2006b) found that individuals still dependent 3 years after having married, divorced, or finished school were at reduced likelihood of subsequent NR, the current study did not support this apparent process of selection, whereby failure to respond quickly to major life events was hypothesized to be a marker of poor prognosis for future recovery. The shorter intervals since onset of dependence in the current sample may account for this inconsistency, in that many of the transitions occurring 3 years prior to baseline in the current sample would

have occurred prior to the onset of dependence. The present study also did not replicate the positive association of AR with recently having become a parent from this earlier analysis but did find that having an infant in the household at baseline had significant positive association with AR ($p=.037$) as well as a positive association of marginal significance ($p=.072$) with NR. Only about 10% of the individuals who had a first child <3 years prior to baseline reported an infant <1 year of age living in the household, less than would be expected if the births had been distributed evenly over the follow-up interval and all children had remained in the household. This suggests that some baseline alcohol dependent individuals who had recently become parents were no longer living with the child in question, possibly because of having separated from the custodial parent, had the child removed by legal authorities or voluntarily given the child up for adoption or foster care. Thus, the associations of AR and NR with having an infant in the household may represent recovered individuals being more likely still to be living with their offspring (selectivity) rather than a direct protective effect of parenthood.

The current study revealed some significant correlates of recovery not examined in earlier analyses of the Wave 1 NESARC data. Consistent with other studies (Koenig and Vaillant, 2009; Prescott et al., 1997), religiosity (frequency of attendance at religious services) showed a strong positive association with recovery although spirituality, which has also showed strong associations with recovery in other studies (Kelly et al., 2010; Miller 1998; Robinson et al., 2007; Zeng, 2007), did not. This suggests that the support system and social norms associated with participation in a religious community may offer more benefits for recovery than any inner strength or equanimity conferred by spiritual beliefs. In addition, any independent association between recovery and spirituality may have been mediated by the treatment variables, which distinguished formal treatment from participation in 12-step programs that often have a strong spiritual component.

Another new finding was the positive association of NR with job problems and unemployment. When the group of individuals not employed in the past year was examined in depth (data not shown), the excess odds of NR were particularly high for retirees ($OR = 10.87$, $p = .001$), among whom budgetary constraints and lifestyle changes including widowhood may be associated with reduced drinking. The surprising lack of comparable associations with AR requires further study but may reflect continued (albeit reduced) use of alcohol to self-medicate the stresses related to job problems or not being employed.

The current study was characterized by a number of limitations. These include the modest sample size (reducing the statistical power to detect associations), the fact that many of the covariates of interest had a very low prevalence, and the relatively brief follow-up interval. Although the analytic sample comprised individuals of diverse ages and varying lengths of dependence at baseline, the sample size did not permit examining potentially informative interactions of length of dependence or age cohort with the other correlates of recovery. Additionally, our measures of help-seeking may have included very brief encounters with the treatment and 12-step systems, as frequency of participation was not ascertained.

Despite these limitations, the results of this analysis contributed to its dual aims of clarifying factors associated with recovery from alcohol dependence and identifying various aspects of study design that need to be considered in the interpretation of research findings, especially discrepant findings. From a substantive perspective, the results supported both the importance of 12-step participation for recovery and the feasibility of maturing out of alcohol dependence (Gotham et al., 1997; Kandel, 1980; Labouvie, 1996; Watson and Sher, 1998). This study also replicated the strong association of religiosity with recovery that has been reported elsewhere, despite not being able to address its causal role. Although multiple methodological differences with respect to earlier papers made it impossible to attribute

discrepant findings to any single factor with certainty, this study demonstrated that cross-sectional analyses of lifetime correlates of recovery require careful interpretation, with many associations plausibly reflecting effects of selectivity. However, when cross-sectional survey data are used in pseudo-prospective survival analyses with time-dependent covariates, the results may be as valid as those from prospective studies with short follow-up intervals. That is, the advantages of having a fixed follow-up interval for individuals who are alcohol dependent at a single point in time may be outweighed by the advantages of being able to examine longer intervals of varying lengths among individuals who were ever dependent at any time in their lives. Although a prospective survey that incorporated multiple follow-up measurements over a long interval for a nationally representative sample would appear to offer the advantages of both types of study design, such an approach is highly resource-intensive, and multiple follow-up interviews may decrease the ultimate rate of retention. Finally, it is important to bear in mind that longer observation periods, regardless of whether prospectively or retrospectively ascertained, always introduce issues of selectivity and attrition that must be borne in mind when interpreting correlates of recovery.

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Table 1

Wave 2 past-year recovery status as a function of baseline sociodemographic and clinical characteristics: U.S. individuals with baseline past-year DSM-IV alcohol dependence

Baseline characteristic	n	Wave 2 past-year recovery status			Chi square p-value
		Abstinent recovery	Nonabstinent recovery	No recovery	
Total	1,172	5.4 (0.7)	5.5 (0.8)	89.0 (1.0)	
Ages 18-24	402	5.6 (1.3)	4.8 (1.3)	89.6 (1.8)	.811
Ages 25-39	426	4.7 (1.0)	6.5 (1.4)	88.8 (1.7)	
Ages 40+	344	6.2 (1.5)	5.3 (1.3)	88.4 (1.9)	
Male	738	5.8 (1.0)	4.5 (0.8)	89.7 (1.2)	.148
Female	434	4.5 (1.1)	7.8 (1.6)	87.7 (1.9)	
White	698	4.3 (0.8)	4.7 (0.8)	91.0 (1.1)	.378
Black/African-American	196	7.7 (2.2)	8.2 (2.5)	84.1 (3.1)	
Native American/Alaska Native	30	4.8 (4.7)	5.7 (3.7)	89.6 (5.9)	
Asian/Pacific Islander	17	5.1 (5.0)	14.4 (10.0)	80.5 (10.7)	
Hispanic	231	9.2 (2.8)	6.4 (1.9)	84.4 (3.3)	
Married/cohabiting/widowed	398	4.8 (1.1)	6.8 (1.4)	88.4 (1.7)	.009
Divorced/separated	228	8.4 (2.0)	9.6 (2.2)	82.0 (2.9)	
Never married	546	5.0 (1.1)	3.4 (0.8)	91.6 (1.3)	
Initiation of 1 st marriage in past 3 years	54	6.3 (2.6)	15.2 (5.4)	78.5 (5.7)	.044
Initiation of 1 st marriage 3+ years ago	519	5.7 (1.1)	6.8 (1.1)	87.5 (1.5)	
No initiation of 1 st marriage	596	5.2 (1.1)	3.6 (0.9)	91.2 (1.2)	
Termination of 1 st marriage in past 3 years	57	12.0 (4.8)	16.8 (5.9)	71.2 (7.1)	.088
Termination of 1 st marriage 3+ years ago	233	6.9 (1.8)	6.5 (1.7)	86.6 (2.5)	
No termination of 1 st marriage	877	4.8 (0.8)	4.8 (0.8)	90.4 (1.0)	
Children <1 year of age in household	15	9.7 (5.6)	12.2 (7.3)	78.1 (8.9)	.443
No children <1 year of age in household	1,157	5.4 (0.8)	5.5 (0.8)	89.2 (1.0)	
First became parent in past 3 years	49	4.5 (2.9)	11.2 (5.7)	84.3 (6.3)	.798
First became parent 3+ years ago	520	5.5 (1.0)	5.9 (1.1)	88.6 (1.4)	

Baseline characteristic	n	Wave 2 past-year recovery status			Chi square p-value
		Abstinent recovery	Nonabstinent recovery	No recovery	
Did not first become parent	601	5.4 (1.1)	4.9 (0.9)	89.7 (1.4)	
Attended/completed college	620	5.3 (1.0)	5.6 (1.0)	89.1 (1.4)	.986
Did not attend college	552	5.5 (1.0)	5.5 (1.0)	89.0 (1.4)	
Completed education in past 3 years	92	6.4 (2.8)	3.8 (1.7)	89.9 (3.2)	.756
Completed education 3+ years ago	749	5.5 (0.9)	6.2 (1.0)	88.3 (1.3)	
Did not complete education (still student)	325	5.1 (1.5)	4.8 (1.3)	90.1 (1.9)	
Employed in past year with no job problems	595	6.3 (1.2)	2.9 (0.6)	90.8 (1.2)	.005
Employed in past year with job problems	460	3.8 (0.9)	8.3 (1.6)	87.9 (1.8)	
Not employed in past year	117	6.9 (2.2)	9.9 (3.0)	83.2 (3.5)	
Started 1 st full-time job in past 3 years	116	3.6 (1.8)	7.9 (2.7)	88.5 (3.1)	.346
Started 1 st full-time job 3+ years ago	936	5.9 (0.9)	4.9 (0.7)	89.2 (1.1)	
Did not start 1 st full-time job	118	3.7 (1.6)	8.1 (2.6)	88.3 (3.0)	
Family history of alcoholism	865	5.8 (0.9)	5.1 (0.9)	89.2 (1.2)	.467
No family history of alcoholism	307	4.4 (1.3)	6.8 (1.6)	88.8 (2.0)	
No past-year medical conditions	880	5.6 (0.9)	5.3 (0.8)	89.1 (1.1)	.144
One past-year medical condition	171	5.2 (1.7)	2.6 (1.4)	92.2 (2.2)	
Two or more past-year medical conditions	121	4.1 (1.4)	11.7 (3.5)	84.2 (3.6)	
Private health insurance	678	4.7 (1.0)	5.4 (0.9)	90.0 (1.3)	.497
Public health insurance (e.g., Medicaid)	141	6.3 (1.8)	9.3 (2.9)	84.4 (3.3)	
No health insurance	353	6.6 (1.4)	4.7 (1.2)	88.8 (1.9)	
Never attends services at follow-up	769	4.4 (0.8)	4.1 (0.8)	91.5 (1.1)	.016
Attends services <weekly at follow-up	260	5.6 (1.7)	11.3 (2.1)	83.1 (2.7)	
Attends services weekly at follow-up	143	11.1 (3.2)	3.4 (1.4)	85.4 (3.5)	
Spiritual beliefs very important	493	7.0 (1.2)	7.5 (1.2)	85.5 (1.6)	.052
Spiritual beliefs somewhat important	418	4.8 (1.1)	5.0 (1.2)	90.3 (1.6)	
Spiritual beliefs not very/not at all important	260	3.9 (1.6)	3.5 (1.3)	92.7 (2.1)	
Any past-year mood disorder	345	5.4 (1.3)	5.7 (1.4)	88.8 (1.9)	.984
No past-year mood disorder	827	5.4 (0.9)	5.5 (0.8)	89.1 (1.2)	

Baseline characteristic	n	Wave 2 past-year recovery status			Chi square p-value
		Abstinent recovery	Nonabstinent recovery	No recovery	
Any past-year anxiety disorder	263	3.8 (1.32)	5.2 (1.6)	91.0 (1.9)	.351
No past-year anxiety disorder	909	6.0 (0.9)	5.6 (0.8)	88.4 (1.1)	
Any personality disorder	604	5.9 (1.2)	6.1 (1.2)	88.0 (1.6)	.556
No personality disorder	568	4.9 (0.9)	5.0 (0.9)	90.1 (1.2)	
Past-year smoker	717	4.5 (0.8)	4.0 (0.8)	91.5 (1.1)	.008
Past-year nonsmoker	455	6.9 (1.5)	8.2 (1.4)	84.8 (1.9)	
Past-year drug use without disorder	306	4.1 (1.1)	3.3 (1.0)	92.6 (1.5)	.006
Past-year drug use disorder	123	4.8 (2.5)	1.6 (0.9)	93.7 (2.6)	
No past-year drug use	743	6.2 (1.0)	7.5 (1.2)	86.4 (1.4)	
Age 1 st drink = 14 or younger	220	6.2 (1.7)	4.4 (1.5)	89.4 (2.1)	.805
Age first drink = 15-17	486	5.0 (1.2)	4.9 (0.9)	90.1 (1.4)	
Age first drink = 18 or older	463	5.5 (1.2)	6.7 (1.5)	87.8 (1.9)	
Past-year avg. daily ethanol intake <1 oz.	393	5.2 (1.3)	9.2 (1.8)	85.6 (2.0)	.061
Past-year avg. daily ethanol intake 1-3 oz.	386	4.3 (1.1)	4.1 (1.1)	91.6 (1.5)	
Past-year avg. daily ethanol intake >3 oz.	389	6.7 (1.4)	3.4 (0.9)	89.9 (1.6)	
<1 yrs. since most recent onset dependence	631	4.4 (0.9)	6.2 (1.1)	89.4 (1.4)	.586
1-4 yrs. since most recent onset dependence	274	5.8 (1.7)	4.6 (1.4)	89.6 (2.2)	
5+ yrs. since most recent onset dependence	250	7.1 (1.9)	5.3 (1.6)	87.7 (2.2)	
Age at onset of dependence <25	513	4.8 (1.0)	6.8 (1.2)	88.4 (1.5)	.446
Age at onset of dependence 25+	642	5.5 (1.0)	4.9 (1.0)	89.6 (1.4)	
Prior episode(s) of dependence	274	4.1 (1.4)	4.7 (1.5)	91.2 (1.9)	.475
No prior episode(s) of dependence	898	5.8 (0.9)	5.8 (0.9)	88.4 (1.2)	
1-5 past-year AUD symptoms	287	4.6 (1.3)	6.3 (1.5)	89.2 (2.0)	.045
6-11 past-year AUD symptoms	472	4.0 (1.0)	7.0 (1.2)	89.0 (1.6)	
12+ past-year AUD symptoms	413	7.5 (1.4)	3.6 (1.0)	89.0 (1.7)	
Initiated alcohol treatment, including 12-step, within past 3 years	51	27.0 (7.6)	6.6 (3.3)	66.4 (7.9)	.112
Initiated alcohol treatment, excluding 12-step, within past 3 years	36	2.7 (1.9)	3.7 (2.4)	93.7 (3.1)	

Baseline characteristic	n	Wave 2 past-year recovery status			Chi square p-value
		Abstinent recovery	Nonabstinent recovery	No recovery	
Initiated alcohol treatment, including 12-step, 3+ years ago	153	6.7 (2.0)	3.1 (1.5)	90.1 (2.4)	
Initiated alcohol treatment, excluding 12-step, 3+ years ago	30	2.0 (2.0)	4.8 (4.7)	93.3 (5.1)	
No treatment/12-step	897	4.3	(0.8)	6.0 (0.9)	89.7 (1.2)

^a Includes individuals currently cohabiting if never formally married

Table 2

Selected parameters from full and reduced models predicting the achievement of abstinent and nonabstinent recovery from DSM-IV alcohol dependence (both versus no recovery) during a three-year follow-up interval: U.S. adults 18 and older at baseline

Baseline characteristic, unless otherwise specified	Models predicting abstinent recovery						Models predicting nonabstinent recovery					
	Full model			Reduced model			Full model			Reduced model		
	Beta	SE	p	Beta	SE	p	Beta	SE	p	Beta	SE	p
Male	0.316	.384	.415	---	---	---	0.085	.277	.760	---	---	---
Black/Asian/Hispanic	0.558	.368	.137	0.695	.305	.028	0.158	.359	.662	---	---	---
Divorced/separated ^a	0.649	.412	.122	0.709	.392	.078	0.843	.419	.050	0.734	.414	.083
Never married ^a	0.024	.374	.949	0.255	.351	.471	-1.159	.441	.012	-0.882	.342	.014
Children <1 year of age	1.142	.772	.146	1.326	.616	.037	1.509	.745	.049	1.394	.756	.072
Employed with job problems in past year ^b	-0.720	.374	.061	-0.608	.355	.094	1.698	.302	<.001	1.647	.310	<.001
Not employed in past year ^b	0.170	.479	.724	0.037	.436	.933	1.227	.417	.005	1.341	.412	.002
Family history of alcoholism	0.230	.402	.569	---	---	---	-0.301	.356	.403	---	---	---
One past-year medical condition ^c	-0.135	.440	.761	---	---	---	-0.900	.552	.110	-0.988	.514	.061
Two or more past-year medical conditions ^c	-0.421	.515	.419	---	---	---	0.957	.375	.014	0.720	.358	.051
Private health insurance ^d	-0.278	.373	.460	---	---	---	0.073	.342	.832	---	---	---
Public health insurance (Medicaid, etc.) ^d	-0.037	.454	.935	---	---	---	0.429	.460	.356	---	---	---
Attended religious services at follow-up, <1/wk ^e	0.349	.462	.454	0.386	.412	.354	1.088	.346	.003	1.099	.300	.001
Attended religious services at follow-up, 1/wk ^e	0.834	.518	.114	0.963	.397	.019	-0.370	.606	.545	-0.512	.583	.385
Spiritual beliefs very important ^f	0.314	.599	.603	---	---	---	0.254	.485	.603	---	---	---
Spiritual beliefs somewhat important ^f	0.076	.497	.879	---	---	---	0.183	.514	.724	---	---	---
Past-year anxiety disorder	-0.427	.487	.385	---	---	---	-0.433	.324	.189	---	---	---
Past-year smoker	-0.505	.332	.136	-0.575	.312	.073	-0.765	.354	.037	-0.879	.341	.014
Past-year drug use without disorder ^g	-0.617	.403	.133	---	---	---	-0.368	.386	.346	-0.443	.382	.252
Past-year drug use disorder ^g	-0.379	.789	.633				-1.193	.677	.085	-1.257	.645	.058

Baseline characteristic, unless otherwise specified	Models predicting abstinent recovery						Models predicting nonabstinent recovery					
	Full model			Reduced model			Full model			Reduced model		
	Beta	SE	p	Beta	SE	p	Beta	SE	p	Beta	SE	p
Past-year avg. daily ethanol intake (log oz.)	-0.117	.129	.371	---	---	---	-0.458	.128	.001	-0.412	.117	.001
Age at onset of dependence <25	-0.605	.393	.131	---	---	---	-0.366	.451	.421	---	---	---
Prior episode(s) of dependence	-0.505	.441	.259	---	---	---	-0.142	.451	.755	---	---	---
Number of past-year AUD symptoms	0.064	.030	.040	0.044	.026	.095	0.035	.042	.418	---	---	---
Initiated alcohol treatment, including 12-step, within past 3 years ^h	2.233	.480 <.001		2.197	.473	<.001	0.869	.697	.219	---	---	---
Initiated alcohol treatment, excluding 12-step, within past 3 years ^h	-0.397	.872	.651	-0.593	.805	.466	-0.448	.850	.601	---	---	---
Initiated alcohol treatment, including 12-step, 3+ years ago ^h	0.520	.454	.258	0.381	.428	.379	-0.917	.681	.185	---	---	---
Initiated alcohol treatment, excluding 12-step, 3+ years ago ^h	-0.430	1.111	.701	-0.719	.980	.467	0.096	.844	.910	---	---	---

Referents:

- ^a Married, cohabiting, widowed
- ^b Employed with no job problems in past year
- ^c No past-year medical conditions
- ^d No health insurance coverage
- ^e Did not attend religious services
- ^f Spiritual beliefs not very/not at all important
- ^g No drug use
- ^h No treatment/12 step participation prior to baseline