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# What Happens After Treatment? Long-Term Effects of Continued Substance Use, Psychiatric Problems and Help-Seeking on Social Status of Alcohol-Dependent Individuals

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## Abstract

**Purpose:** We examined whether alcohol-dependent individuals with sustained substance use or psychiatric problems after completing treatment were more likely to experience low social status and whether continued help-seeking would improve outcomes.

**Short summary:** Ongoing alcohol, drug and psychiatric problems after completing treatment were associated with increased odds of low social status (unemployment, unstable housing and/or living in high-poverty neighborhood) over 7 years. The impact of drug problems declined over time, and there were small, delayed benefits of AA attendance on social status.

**Method:** Alcohol-dependent individuals sampled from public and private treatment programs ( $N = 491$ ; 62% male) in Northern California were interviewed at treatment entry and 1, 3, 5 and 7 years later. Random effects models tested relationships between problem severity (alcohol, drug and psychiatric problems) and help-seeking (attending specialty alcohol/drug treatment and Alcoholics Anonymous, AA) with low social status (unemployment, unstable housing and/or living in a high-poverty neighborhood) over time.

**Results:** The proportion of participants experiencing none of the indicators of low social status increased between baseline and the 1-year follow-up and remained stable thereafter. Higher alcohol problem scores and having any drug and/or psychiatric problems in the years after treatment were associated with increased odds of low social status over time. An interaction of drug problems with time indicated the impact of drug problems on social status declined over the 7-year period. Both treatment-seeking and AA attendance were associated with increased odds of low social status, although lagged models suggested there were small, delayed benefits of AA attendance on improved social status over time.

**Conclusion:** Specialty addiction treatment alone was not sufficient to have positive long-term impacts on social status and social integration of most alcohol-dependent people.

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## INTRODUCTION

Long-term consequences of alcohol use disorders (AUD) and drug use disorders (DUD) can include downward social migration and loss of social status, also known as 'downward drift'. Indicators of low social status that may be consequences of AUD and DUD include unemployment (Braun *et al.*, 2000; Compton *et al.*, 2014; French *et al.*, 2011), incarceration (Tsai *et al.*, 2013), poverty (Buu *et al.*, 2007) and homelessness (Johnson *et al.*, 1997; McVicar *et al.*, 2015). Some studies suggest the drift phenomenon may be more acute for heavy users of illicit drugs than for heavy drinkers (Compton *et al.*, 2014; Johnson *et al.*, 1997). In this study, we examine effects of both alcohol and drug problems on social status over time.

Prior research suggests many negative sequelae of untreated or ongoing substance use disorders (SUD). In cross-sectional analyses using data from the US National Surveys on Drug Use and Health, Compton and colleagues (2014) found robust associations of alcohol and other drug use with unemployment. They also used retrospective data to assess whether drug use was associated with future unemployment and found cannabis use predicted subsequent job loss. Using data from people ages 25–60 who responded to both Wave I and Wave II of the National Epidemiologic Survey on Alcohol and Related Conditions, French and colleagues (2011) employed fixed effects regression models to examine impacts of alcohol use and AUD on job loss and sustained unemployment over a 3-year period. They found weekly heavy drinking (4+ drinks for women/5+ drinks for men per episode) was associated with women's job loss and AUD was associated with sustained unemployment for both women and men.

Associations with SUD are similar for other indicators of low social status. In comparisons of incarcerated and general-population veterans, Tsai and colleagues (2013) noted that incarcerated veterans were more likely to have SUD than the general population of veterans, and this was particularly acute for African American and Hispanic veterans. Regarding associations of AUD and poverty, Buu *et al.* (2007) found that after conviction for driving under the influence, men with 'active' AUD were more likely to either stay in or move to a disadvantaged neighborhood over a 12-year period than their DUI-convicted peers who never had AUD or who were in remission from AUD. Finally, two studies of homelessness provide strong evidence that SUD is associated with subsequent homelessness (Johnson *et al.*, 1997; McVicar *et al.*, 2015), and that current homelessness also contributes to SUD (Johnson *et al.*, 1997). Johnson and colleagues (1997) noted that DUD was more strongly associated with homelessness in their sample from Chicago, IL USA, than was AUD, but the findings of McVicar and colleagues (2015) suggest more prominent effects of AUD, rather than DUD, on subsequent homelessness in their Australian sample.

For people with SUD, treatment can significantly improve substance use outcomes (Gerstein and Lewin, 1990; Moos and Moos, 2003). Because relapse after treatment is common, repeated treatment episodes can help promote long-term recovery (Hser *et al.*, 1997; Mertens *et al.*, 2005). Involvement with self- and mutual-help groups such as Alcoholics Anonymous (AA) also can significantly improve substance use outcomes over time (Gossop *et al.*, 2008; Kaskutas, 2009; Moos and Moos, 2006), particularly in combination with formal treatment (Fiorentine and Hillhouse, 2000; Moos and Moos, 2006; Witbrodt *et al.*, 2014). Less is known about the benefits of addiction treatment or mutual-help groups for social integration and social status, particularly in the absence of specialized

support services (or wraparound services) to assist with employment, housing, education, psychiatric and other client needs. These problems may be particularly long-lasting and resistant to change: an analysis of the Combining Medications and Behavioral Interventions (COMBINE) Study documented long-term (up to 52 weeks) improvements in mental health and quality of life but the proportion of days paid for working did not show similar improvement in the year after completing treatment (LoCastro *et al.*, 2009). Unfortunately, many treatment agencies do not effectively incorporate these essential support services in their programs (Paino *et al.*, 2016; Polcin, 2016) and those programs which do address ancillary issues such as homelessness often only provide temporary support (Kertesz *et al.*, 2009). An additional limitation of the existing literature is that many studies do not assess secondary treatment outcomes such as social status over a long time period.

To build on prior work, in the present study we examine longitudinal effects of alcohol, drug and psychiatric problems on low social status in a sample of alcohol-dependent individuals followed for 7 years after they completed AUD treatment. Based on extant literature, we hypothesized that, after completing treatment, individuals with sustained substance use or psychiatric problems would be more likely to experience low social status over time. We also expected individuals who continued to receive help (either from formal treatment or from AA) would experience better social status outcomes.

## METHOD

This secondary analysis uses data from a sample of alcohol-dependent individuals recruited when entering public and private alcohol treatment programs in a Northern California County (USA). Original data collection and the subsequent study which added information on the neighborhood context over the longitudinal study period both received approval from the Institutional Review Board of the Public Health Institute, Oakland, CA. All respondents gave their informed consent prior to their inclusion in the longitudinal interview study, and the study was conducted in accordance with the ethical standards established in the 1964 Declaration of Helsinki and its later amendments.

### Sample

Programs included ten first-line programs focused on treating AUD (i.e. stand-alone aftercare and methadone programs were excluded) and that had a least one intake per week. During the study period, the county represented a socially and culturally diverse population (~900,000 county residents at time of recruitment) with a mix of urban, suburban and rural areas that reflected national patterns in the relationship of substance use to other health and social problems (Weisner and Schmidt, 1995). A total of 926 clients agreed to be in the study (80% participation rate) and provided informed consent. One-, 3-, 5- and 7-year follow-ups were conducted using computer-assisted-telephone interviews. Response rates (based on the baseline sample) were 78%, 75%, 72% and 67% at respective follow-ups. More details on initial study recruitment procedures are provided elsewhere (Weisner and Schmidt, 1995).

For this paper, we included all clients who were alcohol dependent at baseline ( $N = 491$ ). The Diagnostic Interview Schedule for Psychoactive Substance Dependence, which operationalizes the seven DSM-IV dependence criteria (American Psychiatric Association, 2000), was used to determine baseline dependence (Robins *et al.*, 1991).

## Measures

### Outcome variable (time-varying)

Social status was measured at the time of each interview. Unstable housing was defined as living in a rooming house, hotel, jail, prison, other institutional setting or being homeless. Unemployment was defined as having no part- or full-time employment. Neighborhood disadvantage was defined as living in a neighborhood where 15% or more of the residents had annual incomes below national poverty standards. This variable was based on national tract-level data from the 2000 US Decennial Census. A composite variable was created to capture whether an individual met one or more of the three conditions at each interview (coded as low social status versus none of the conditions).

### Predictor variables (time-varying)

Addiction Severity Index (ASI) was used to assess past-30-day problem severity for each follow-up period in three domains: alcohol, drug and psychiatric problems (McLellan *et al.*, 1992). The ASI uses key items to produce a continuous composite score for each problem domain (range 0–1, with higher scores designating greater severity). Most studies have shown the ASI to be a reliable and valid instrument (Mäkelä, 2004; McLellan *et al.*, 1992). For these analyses of alcohol-dependent treatment clients, we used the continuous ASI alcohol problem score for each follow-up period. Due to a high number of zeroes and highly skewed data, we used dichotomous indicators to capture co-morbid drug and psychiatric problems (coded as ASI score = 0 versus any indication of problems = 1).

Help-seeking included the number of AA meetings attended during the prior 12 months (range 0–365, capped to signify at most one meeting per day) and any substance use treatment (versus none) in the prior 12 months. At baseline, treatment referred to lifetime treatment received prior to the index (recruitment) episode, and at the 1-year follow-up, treatment only included additional treatment not received as part of the index treatment episode. Treatment could include services received at inpatient care, recovery/residential homes, detoxification or outpatient programs.

### Control variables (time-invariant)

Multivariate models were used to control for several demographic characteristics. Gender (female as the reference group), education (less than a high school diploma compared with high school diploma or higher as the reference), marital status (single—including divorced or widowed with never married—compared with married or partnered as the reference), and ethnicity (minority race/ethnicity compared with Caucasian as the reference) were included in all adjusted models.

A nominal variable was used to denote the type of treatment program from which each individual was recruited. Outpatient programs included two sites in a Health Maintenance Organization offering long-term outpatient treatment (used as the reference group) and two public outpatient programs. Inpatient programs included two fee-for-service private hospital programs offering short-term detoxification and inpatient care, as well as two public, gender-specific and long-term residential programs. There also were two public detoxification sites.

## Analysis

Longitudinal, logistic random intercept models (Twisk, 2013) that specified both linear and quadratic effects for time were used to

estimate the effects of problem severity and help-seeking on social status over time. Random effects models were chosen for these longitudinal data because they efficiently account for correlation between observations of repeated measures (Hu *et al.*, 1998), they work well for balanced designs with limited follow-up points, and they allow for data missing at follow-up points (Twisk, 2013). Compared with general estimating equation models, allowing for random effects also provides more appropriate modeling of individual development over time (Twisk, 2013). Interactions of a focal predictor with the time variables were used to assess changes in the impact of the predictor on the outcome over the 7-year study period. In this context, the main effect can be interpreted as an effect of the predictor on the intercept of the trajectory of social status over time and the interactions represent effects of the predictor on the linear or quadratic slope of the outcome trajectories.

A stepwise approach was taken to estimate a final and most parsimonious model. First, the effects of time (linear and quadratic terms) were included in unadjusted models. Then, models adjusted for the background control variables. Next, main effects and interactions of time and quadratic time with alcohol, drug and psychiatric problems and with the help-seeking variables were added to the adjusted model (results not shown). In the final reduced model, all non-significant ( $P > 0.10$ ) interactions with time were excluded. In sensitivity analyses, the final reduced model was estimated separately for each of the three variables used to create the composite outcome. Then, despite the spacing of the follow-up interviews (2 years between assessments after the 1-year follow-up), we also ran models using lagged predictor variables; these models excluded cases with missing data and did not include interactions with time. All analyses were conducted in Stata, Version 14 (StataCorp., 2015).

## RESULTS

### Descriptive Analysis

The sample ( $N = 491$ ) was 38% female and 20% had less than a high school degree, 43% reported minority race/ethnicity and 33% were married/partnered at baseline. Mean baseline alcohol, drug and psychiatric problem severity scores (and standard deviations) were 0.588 (0.246), 0.112 (0.131) and 0.451 (0.234), respectively. A high proportion (43%) met criteria for both drug and alcohol dependence at baseline.

More than half of the sample (56%) was interviewed at all four follow-up waves (75% at two or more waves, with an average of 3.8 interviews per person). Compared with those interviewed at all four waves, those not interviewed at all waves were significantly ( $P < 0.05$ ) more likely to be male, unemployed, single, without a high school diploma and in unstable living situations at the baseline interview. Greater baseline alcohol problem severity, but not drug or psychiatric problem severity, also was associated with loss-to-follow-up.

Figure 1 displays the number of participants who experienced zero (bottom portion of bars), one, two or three (top portion of bars) of the social status factors (i.e. being unstably housed, being unemployed and/or living in a disadvantaged neighborhood) at each wave. The proportion of those experiencing none of these factors increased between baseline and the 1-year follow-up and remained fairly stable thereafter; the proportions experiencing two or three factors appeared to decrease at this same point in the study. The proportion of those experiencing one factor remained stable after the 1-year follow-up. Odds of low social status decreased over time

primarily due to changes in unemployment and unstable living conditions, rather than to changes in neighborhood poverty (with the latter being more stable over time).

Table 1 shows predictor and control variables included in the longitudinal models across levels of the dependent variable (low social status) at each interview period. Problem severity (especially drug and psychiatric problems) and treatment attendance were strongly associated with the outcome at every wave, as were the

demographic control variables (excluding gender). In addition, post-baseline alcohol problem severity was higher for those meeting at least one criterion for low social status ( $P < 0.05$  at three waves). Prior AA attendance was associated with social status at baseline but attendance differences were not significantly different at subsequent waves. Correlations among key study variables are presented in Table 2.

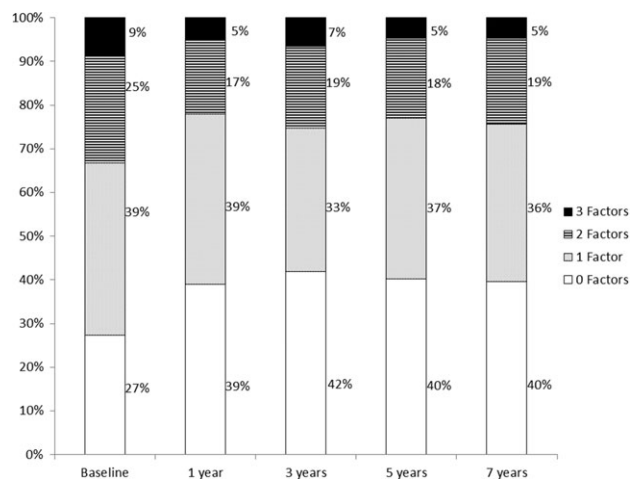


Fig. 1. Prevalence of low social status over time.

### Random Effects Models

Table 3 displays results from the stepwise models for the composite outcome. In the unadjusted model (Model 1), time was significantly and inversely related to low social status, while time-squared was significantly and positively related to low social status. However, in the final adjusted model (Model 3) neither the linear nor quadratic main effects of time were significant, indicating social status did not change significantly from baseline to year 7 after controlling for the effects of problem severity, help-seeking and demographic characteristics. Greater alcohol problem severity (adjusted odds ratio [AOR] = 2.59) and co-morbid drug (AOR = 2.71) and psychiatric (AOR = 1.48) problems were associated with low social status (Model 3;  $P \leq 0.10$  for all). AA attendance and returning to treatment also were associated with low social status over time. Significant interactions of drug problem severity and AA meeting attendance with time indicated that the impact of these variables declined over the 7-year period. In the final model, demographic control variables (less education, female gender, minority race/ethnicity and index treatment program type) remained significantly related to social status across models, with patients recruited

Table 1. Problem severity, help-seeking and demographics by social status over time

|   | Low social status <sup>a</sup> | Baseline         | 1-Year follow-up | 3-Year follow-up | 5-Year follow-up | 7-Year follow-up |
|---|--------------------------------|------------------|------------------|------------------|------------------|------------------|
| Sample size (%)                                     | 0                              | 127 (26)         | 149 (39)         | 153 (42)         | 137 (40)         | 124 (39)         |
|   | 1+                             | 364 (74)         | 235 (61)         | 214 (58)         | 207 (60)         | 190 (61)         |
| ASI alcohol, mean (SD)                              | 0                              | 0.578 (0.252)    | 0.131 (0.187)    | 0.110 (0.170)    | 0.106 (0.175)    | 0.076 (0.133)    |
|   | 1+                             | 0.590 (0.246)    | 0.203 (0.251)**  | 0.136 (0.213)    | 0.152 (0.223)*   | 0.139 (0.211)**  |
| ASI drug, mean (SD)                                 | 0                              | 0.051 (0.091)    | 0.026 (0.051)    | 0.026 (0.051)    | 0.024 (0.048)    | 0.029 (0.055)    |
|   | 1+                             | 0.137 (0.136)*** | 0.064 (0.096)*** | 0.048 (0.087)**  | 0.054 (0.090)**  | 0.052 (0.085)**  |
| % Any drug problem                                  | 0                              | 44.9             | 39.6             | 41.8             | 37.2             | 47.6             |
|   | 1+                             | 70.9***          | 49.8*            | 43.0             | 49.8*            | 54.2             |
| ASI psychiatric, mean (SD)                          | 0                              | 0.415 (0.215)    | 0.155 (0.216)    | 0.164 (0.190)    | 0.176 (0.184)    | 0.126 (0.171)    |
|   | 1+                             | 0.466 (0.237)*   | 0.263 (0.238)*** | 0.275 (0.247)*** | 0.271 (0.229)*** | 0.272 (0.245)*** |
| % Any psychiatric problem                           | 0                              | 88.2             | 45.0             | 58.8             | 61.3             | 46.8             |
|   | 1+                             | 90.1             | 73.2***          | 66.4             | 71.0             | 67.4***          |
| % Went to AA in prior 12 months                     | 0                              | 51.2             | 63.0             | 48.7             | 41.6             | 38.7             |
|   | 1+                             | 71.8***          | 69.3             | 50.7             | 39.6             | 46.6             |
| AA meeting attendance in prior 12 months, mean (SD) | 0                              | 11.38 (33.5)     | 73.88 (106.3)    | 46.03 (85.7)     | 36.02 (73.7)     | 38.79 (83.2)     |
|   | 1+                             | 32.84 (60.3)***  | 74.36 (104.3)    | 34.66 (70.4)     | 31.20 (72.1)     | 23.26 (55.5)     |
| % Went to treatment <sup>b</sup>                    | 0                              | 55.1             | 29.5             | 18.3             | 16.2             | 11.3             |
|   | 1+                             | 75.1***          | 47.7***          | 38.5***          | 25.6*            | 22.1**           |
| % Female  | 0                              | 33.9             | 43.6             | 41.8             | 45.3             | 42.7             |
|   | 1+                             | 38.2             | 41.7             | 40.7             | 39.6             | 41.6             |
| % Less than high school diploma/GED                 | 0                              | 7.9              | 9.4              | 11.1             | 11.0             | 10.5             |
|   | 1+                             | 24.5***          | 22.6***          | 23.4***          | 20.3*            | 21.6**           |
| % Minority race/ethnicity                           | 0                              | 26.0             | 24.8             | 29.4             | 32.9             | 31.5             |
|   | 1+                             | 48.8***          | 47.4***          | 50.2***          | 48.5***          | 52.4***          |
| % Married/partnered                                 | 0                              | 50.4             | 48.3             | 43.8             | 43.1             | 46.0             |
|   | 1+                             | 28.0***          | 29.8***          | 31.8*            | 33.3             | 34.2*            |

SD, standard deviation; ASI, alcohol severity index; AA, Alcoholics Anonymous; GED, high school diploma equivalent; significance levels for bivariate comparisons of those with and without an indicator of low social status: \* $P \leq 0.05$ , \*\* $P \leq 0.01$ , \*\*\* $P \leq 0.001$ . <sup>a</sup>Sum of three social status indicators: living in a low poverty neighborhood, living in unstable housing situation and being unemployed (dichotomized as 0 versus 1+). <sup>b</sup>Treatment use at baseline was assessed for lifetime prior to recruitment episode and for past year thereafter.

**Table 2.** Correlations among time-varying values for key study variables

|  | (3)    | (4)    | (5)    | (6)    | (7)     | (8)     | (9)     | (10)    | (11)    | (12)    | (13)    |
|--|--------|--------|--------|--------|---------|---------|---------|---------|---------|---------|---------|
| (1) Low social status                                | 1      | 1      | 0.311* | 0.011  | -0.236* | 0.322*  | 0.157*  | 0.202*  | 0.270*  | -0.019  | 0.332*  |
| (2) Unstable housing                                 | 0.488* | 0.316* | 0.210* | 0.322* | -0.417* | 0.287*  | 0.095*  | 0.186*  | 0.196*  | 0.038   | 0.448*  |
| (3) Unemployed                                       | 1      | 0.273* | 0.332* | -0.057 | -0.232* | 0.128*  | 0.178*  | 0.236*  | 0.267*  | -0.004  | 0.302*  |
| (4) High-poverty neighborhood                        |        | 1      | 0.267* | 0.152* | -0.158* | 0.574*  | 0.027   | 0.112*  | 0.150*  | -0.038  | 0.150*  |
| (5) Low education <sup>a</sup>                       |        |        | 1      | -0.056 | -0.094* | 0.302*  | 0.043   | 0.154*  | 0.162*  | -0.077* | 0.076   |
| (6) Male <sup>b</sup>                                |        |        |        | 1      | -0.014  | 0.166*  | 0.013   | 0.020   | -0.103* | -0.024  | 0.117*  |
| (7) Married/partnered <sup>c</sup>                   |        |        |        |        | 1       | -0.134* | -0.011  | -0.160* | -0.109* | -0.055* | -0.094* |
| (8) Minority race/ethnicity <sup>b,d</sup>           |        |        |        |        |         | 1       | -0.061* | 0.127*  | 0.062   | -0.046* | 0.058   |
| (9) ASI alcohol problems                             |        |        |        |        |         |         | 1       | 0.202*  | 0.343*  | -0.115* | 0.381*  |
| (10) Any co-morbid drug problems <sup>e</sup>        |        |        |        |        |         |         |         | 1       | 0.459*  | -0.053* | 0.207*  |
| (11) Any co-morbid psychiatric problems <sup>e</sup> |        |        |        |        |         |         |         |         | 1       | -0.037  | 0.345*  |
| (12) # AA meetings attended                          |        |        |        |        |         |         |         |         |         | 1       | 0.152*  |
| (13) Returned to alcohol treatment <sup>f</sup>      |        |        |        |        |         |         |         |         |         |         | 1       |

Tetrachoric correlations among dichotomous indicators; Pearson's correlations for continuous variables indicated with *italics*.

\* $P < 0.05$

<sup>a</sup>Referent: At least a high school diploma or GED.

<sup>b</sup>Baseline value (not time-varying).

<sup>c</sup>Referent: Single, divorced or widowed.

<sup>d</sup>Referent: White/Caucasian.

<sup>e</sup>Referent: No problems.

<sup>f</sup>Referent: Did not go to treatment in past year.

from detoxification sites and inpatient programs showing worse outcomes than outpatient clients over time.

Results of random effects models for the three separate factors comprising the composite social status variable (Table 4) showed that the relationship between alcohol problem severity and social status was driven primarily by the association between alcohol problems and unemployment (AOR = 2.33); alcohol problem severity was not significantly related to unstable housing or living in a high-poverty neighborhood. Drug problem severity also was only significantly related to unemployment, and psychiatric problem severity was not associated with any of the three indicators of social status. As with the composite outcome variable, there were significant interactions of drug problem severity and AA meeting attendance with time when predicting unemployment. Returning to treatment was associated with higher odds of both unemployment and unstable housing. The strongest predictors of living in a high-poverty neighborhood were minority race/ethnicity (AOR = 28.61) and being recruited from a detoxification program (AOR = 10.97).

The models using lagged variables (full models available upon request) showed that 30-day alcohol, drug and psychiatric problems reported at a prior interview were not significantly associated with social status assessed 2 years later, but prior AA meetings attended marginally reduced the odds of having indicators of low social status later (AOR = 0.998; 95% CI = 0.995, 1.000;  $P < 0.10$ ). As in the concurrent models, reports of returning to treatment during a previous interview also were associated with marginally higher odds of low social status later (AOR = 1.52; 95% CI = 0.97, 2.38;  $P < 0.10$ ). These lagged effects were consistent with the concurrent predictors in the model as well. When accounting for lagged effects, alcohol problem severity (AOR = 3.06; 95% CI = 0.91, 10.30;  $P < 0.10$ ) and psychiatric problems (AOR = 1.83; 95% CI = 1.14, 2.93;  $P < 0.05$ ) in the 30 days prior to the interview and returning to treatment in the 12 months prior to the interview (AOR = 2.12; 95% CI = 1.27, 3.55;  $P < 0.01$ ) were associated with higher odds of low social status over time.

## DISCUSSION

In this sample of alcohol-dependent treatment clients, after accounting for covariates, social status did not change significantly over the 7-year follow-up period. The proportion of people reporting none of the indicators of low social status increased from 27% at baseline to ~40% for all subsequent waves, demonstrating that those who were relatively less disadvantaged maintained this status over time. Although the proportion with low social status at baseline did not markedly improve after the 1-year follow-up, there was a reduction in the proportion of people who reported two or more indicators of low social status over time. Changes in social status were largely due to changes in employment and housing status, rather than changes in neighborhood poverty. Using a much shorter 1-year follow-up period, LoCastro and colleagues (2009) noted relatively little change in one employment outcome (proportion of days paid for work) after completing treatment as part of the COMBINE trial. Secondary benefits of alcohol and drug treatment such as re-employment, achieving and/or maintaining stable housing, and improved economic circumstances may require substantial targeted programming and relatively long time periods before they emerge. Programs that integrate more of a social model approach to service provision (Kaskutas, 1998) may be particularly beneficial for these secondary treatment outcomes, especially if they emphasize employment and housing support.

We also found low social status over time was predicted by ongoing alcohol, drug and psychiatric problems; continued AA attendance and ongoing treatment; as well as several demographic characteristics, including minority race/ethnicity, having less than a high school education and being female. In our sample, the relationship of drug problems with low social status weakened significantly over time. Others have documented long-term negative impacts of ongoing AUD on poverty (Buu *et al.*, 2007) and unemployment (French *et al.*, 2011), but the pattern of results for ongoing service utilization (both formal treatment and AA) was counter to our expectations, as there was little improvement over time even for

**Table 3.** Adjusted odds ratios and 95% confidence intervals from stepwise random effect models of time, demographics, problem severity and service utilization regressed on composite indicator of low social status across waves

|   | Model 1 |               | Model 2            |               | Model 3            |               |
|---|---------|---------------|--------------------|---------------|--------------------|---------------|
|   | OR      | 95% CI        | OR                 | 95% CI        | OR                 | 95% CI        |
| Time  | 0.580** | (0.469–0.718) | 0.603**            | (0.487–0.745) | 1.003              | (0.762–1.322) |
| Time-squared  | 1.070** | (1.037–1.104) | 1.065**            | (1.032–1.099) | 1.024              | (0.987–1.061) |
| Effects on intercept                                  |         |               |                    |               |                    |               |
| Less than high school education <sup>a</sup>          |         |               | 3.423**            | (1.556–7.527) | 3.380**            | (1.491–7.662) |
| Male  |         |               | 0.588 <sup>+</sup> | (0.329–1.054) | 0.517*             | (0.282–0.947) |
| Married/partnered <sup>b</sup>                        |         |               | 0.569 <sup>+</sup> | (0.315–1.027) | 0.558 <sup>+</sup> | (0.304–1.027) |
| Minority race/ethnicity <sup>c</sup>                  |         |               | 2.354**            | (1.296–4.272) | 2.417**            | (1.304–4.481) |
| Type of treatment program at recruitment <sup>d</sup> |         |               |                    |               |                    |               |
| Other outpatient                                      |         |               | 1.130              | (0.490–2.603) | 1.044              | (0.443–2.462) |
| Hospital inpatient                                    |         |               | 7.798**            | (3.633–16.74) | 6.679**            | (3.018–14.78) |
| Long-term residential                                 |         |               | 4.925**            | (1.667–14.55) | 4.724**            | (1.548–14.41) |
| Detoxification  |         |               | 21.480**           | (7.907–58.36) | 18.150**           | (6.486–50.79) |
| ASI alcohol problem severity                          |         |               |                    |               | 2.586*             | (1.156–5.785) |
| Any drug problems <sup>e</sup>                        |         |               |                    |               | 2.707**            | (1.607–4.558) |
| Any psychiatric problems <sup>e</sup>                 |         |               |                    |               | 1.476 <sup>+</sup> | (0.999–2.180) |
| # of AA meetings attended past year                   |         |               |                    |               | 1.004*             | (1.000–1.007) |
| Went to treatment in past year <sup>f</sup>           |         |               |                    |               | 2.122**            | (1.443–3.121) |
| Effects on linear slope <sup>g</sup>                  |         |               |                    |               |                    |               |
| Any drug problems                                     |         |               |                    |               | 0.821**            | (0.726–0.928) |
| # of AA meetings attended past year                   |         |               |                    |               | 0.999**            | (0.998–1.000) |
| Constant  | 7.362** | (4.899–11.06) | 2.070*             | (1.069–4.007) | 0.358*             | (0.150–0.852) |
| /lnsig2u  | 2.080   | (1.784–2.376) | 1.716              | (1.407–2.030) | 1.756              | (1.437–2.070) |
| sigma_u   | 2.830   | (2.442–3.280) | 2.358              | (2.020–2.750) | 2.406              | (2.052–2.820) |
| Rho   | 0.709   | (0.644–0.766) | 0.628              | (0.554–0.700) | 0.638              | (0.561–0.710) |
| Observations  | 1,900   |               | 1,895              |               | 1,855              |               |
| Number of cases                                       | 491     |               | 490                |               | 488                |               |

\* $P < 0.05$ , \*\* $P < 0.01$ , + $P < 0.1$ .

<sup>a</sup>Referent: At least a high school diploma or GED.

<sup>b</sup>Referent: Single, divorced or widowed.

<sup>c</sup>Referent: White/Caucasian.

<sup>d</sup>Referent: HMO Outpatient.

<sup>e</sup>Referent: No problems.

<sup>f</sup>Referent: Did not go to treatment in past year.

<sup>g</sup>Note: Interaction with Time.

those who sought additional treatment. Prior research has suggested that clients benefit from receiving continued support after an index treatment event (Mertens *et al.*, 2005) or from involvement with AA after treatment (Fiorentine and Hillhouse, 2000; Moos and Moos, 2006; Witbrodt *et al.*, 2014). In this sample, however, ongoing service utilization indicated relatively poor prognosis that may have been concurrent with an event of unemployment, homelessness or incarceration. It is noteworthy that the association of AA attendance with low social status weakened over time and that the lagged models suggested there may be a long-term protective effect of continued AA involvement. This question deserves further study. Future studies also could investigate mechanisms of effect, such as the contribution of police surveillance to arrest (and therefore imprisonment and loss of social status) of people after AUD treatment (particularly among people of minority race/ethnicity) or the contribution of heavy drinkers in the networks of homeless people (Wenzel *et al.*, 2012) to ongoing AUD or to social status over time.

### Study Limitations and Strengths

A strength of our study is that we used an outcome that combined several relatively severe conditions such as unemployment, living in

unstable housing or being homeless, incarceration and living in an impoverished area. However, a study limitation is that we did not have information on the duration or onset of episodes of unemployment or living in unstable or impoverished conditions. Our study was primarily concerned with the hypothesis that there is a selection effect that links social status with alcohol problems; that is, people with AUD lose social status over time. Another possibility is that there is an influence effect, whereby exposure to conditions of low social status (such as unemployment or poverty) causes alcohol and other drug problems over time (Buu *et al.*, 2007; Johnson *et al.*, 1997). Use of disaggregated outcomes in larger samples and with detailed information on timing of outcomes would allow for more specificity in the conclusions we can draw about how AUD impacts social status over time. Future studies with larger samples should seek to replicate our findings from this representative group of alcohol treatment program clients.

We do not know details about exactly what supportive services were received at each treatment episode, and we do not know about such services the clients may have received elsewhere, such as through mental health providers or the welfare system (Ammon *et al.*, 2008). Additional research using program administrative data could be informative for describing the contribution of particular

**Table 4.** Adjusted odds ratios and 95% confidence intervals from random effect models of time, demographics, problem severity and service utilization regressed on three indicators of low social status across waves

|   | Unstable housing   |               | Unemployed         |               | High-poverty neighborhood |               |
|---|--------------------|---------------|--------------------|---------------|---------------------------|---------------|
|   | OR                 | 95% CI        | OR                 | 95% CI        | OR                        | 95% CI        |
| Time  | 1.032              | (0.744–1.431) | 0.941              | (0.738–1.200) | 1.109                     | (0.791–1.554) |
| Time-squared  | 0.994              | (0.952–1.038) | 1.024              | (0.992–1.057) | 0.994                     | (0.951–1.038) |
| Effects on intercept                                  |                    |               |                    |               |                           |               |
| Less than high school education <sup>a</sup>          | 1.514              | (0.881–2.601) | 4.214**            | (2.253–7.882) | 3.678*                    | (1.300–10.41) |
| Male  | 2.608**            | (1.573–4.323) | 0.503**            | (0.314–0.805) | 1.873                     | (0.795–4.416) |
| Married/partnered <sup>b</sup>                        | 0.330**            | (0.188–0.580) | 0.646 <sup>+</sup> | (0.400–1.043) | 0.622                     | (0.256–1.514) |
| Minority race/ethnicity <sup>c</sup>                  | 1.672*             | (1.031–2.714) | 0.976              | (0.607–1.570) | 28.610**                  | (11.69–70.01) |
| Type of treatment program at recruitment <sup>d</sup> |                    |               |                    |               |                           |               |
| Other outpatient                                      | 3.557**            | (1.496–8.457) | 1.297              | (0.645–2.610) | 0.954                     | (0.246–3.701) |
| Hospital inpatient                                    | 5.468**            | (2.685–11.14) | 6.633**            | (3.579–12.30) | 2.542 <sup>+</sup>        | (0.869–7.432) |
| Long-term residential                                 | 18.070**           | (7.485–43.61) | 4.782**            | (1.996–11.46) | 2.107                     | (0.453–9.793) |
| Detoxification  | 17.220**           | (8.099–36.62) | 8.842**            | (4.247–18.41) | 10.970**                  | (3.061–39.35) |
| ASI alcohol problem severity                          | 1.059              | (0.471–2.384) | 2.329*             | (1.187–4.567) | 1.394                     | (0.548–3.547) |
| Any drug problems <sup>e</sup>                        | 1.673 <sup>+</sup> | (0.960–2.915) | 2.525**            | (1.620–3.937) | 1.043                     | (0.548–1.986) |
| Any psychiatric problems <sup>e</sup>                 | 1.373              | (0.850–2.218) | 1.267              | (0.894–1.796) | 1.288                     | (0.779–2.131) |
| # of AA meetings attended past year                   | 1.000              | (0.997–1.003) | 1.003 <sup>+</sup> | (1.000–1.005) | 0.999                     | (0.996–1.003) |
| Went to treatment in past year <sup>f</sup>           | 2.594**            | (1.708–3.938) | 1.760**            | (1.264–2.449) | 1.063                     | (0.673–1.679) |
| Effects on linear slope <sup>g</sup>                  |                    |               |                    |               |                           |               |
| Any drug problems                                     | 0.892              | (0.770–1.034) | 0.885*             | (0.796–0.985) | 1.015                     | (0.875–1.177) |
| # of AA meetings attended past year                   | 1.000              | (0.999–1.001) | 0.999*             | (0.998–1.000) | 1.000                     | (0.999–1.001) |
| Constant  | 0.004**            | (0.002–0.012) | 0.204**            | (0.099–0.419) | 0.004*                    | (0.001–0.015) |
| /lnsig2u  | 0.586              | (0.076–1.100) | 1.251              | (0.939–1.560) | 2.605                     | (2.277–2.930) |
| sigma_u   | 1.340              | (1.039–1.730) | 1.869              | (1.599–2.190) | 3.678                     | (3.122–4.330) |
| Rho   | 0.353              | (0.247–0.480) | 0.515              | (0.437–0.590) | 0.804                     | (0.748–0.850) |
| Observations  | 1,871              |               | 1,867              |               | 1,824                     |               |
| Number of cases                                       | 497                |               | 497                |               | 467                       |               |

\* $P < 0.05$ , \*\* $P < 0.01$ , <sup>+</sup> $P < 0.1$ .

<sup>a</sup>Referent: At least a high school diploma or GED.

<sup>b</sup>Referent: Single, divorced or widowed.

<sup>c</sup>Referent: White/Caucasian.

<sup>d</sup>Referent: HMO Outpatient.

<sup>e</sup>Referent: No problems.

<sup>f</sup>Referent: Did not go to treatment in past year.

<sup>g</sup>Note: Interaction with time.

programmatic elements to client outcomes. Replication of these results using newer data also would be beneficial, although the findings from this representative treatment sample that included a 7-year follow-up period and linked neighborhood data offer a contribution to the extant literature on long-term sequelae of alcohol and drug problems. Finally, there was loss-to-follow-up over the course of the study, although the response rate at the final interview still was respectable (67%) for a sample recruited from alcohol treatment programs. Alcohol problem severity at baseline was associated with attrition, but we note that the proportion of cases with low social status was highly stable over time, which suggests that there was not selective attrition of these people over the course of the study.

### Recommendations for Future Research

We restricted our current sample to participants with a DSM-IV diagnosis of alcohol dependence who were enrolled in alcohol treatment. Future studies should assess social status and long-term social integration of alcohol-dependent individuals who do not receive treatment. Replication with established multi-dimensional measures of social status, such as the Townsend Index which incorporates

employment status, car ownership and housing tenure/crowding (Krieger *et al.*, 2003; Morris and Carstairs, 1991), also may be instructive for improving treatment services and social integration of people with AUD. Long-term follow-up of individuals who obtain additional services such as employment and housing support during and after AUD treatment will help us to better understand the dynamics between problem severity and long-term social status. The current analyses focused on past-30-day problem severity as the primary independent variables; additional research on the role of abstinence and other measures of recovery (Kaskutas *et al.*, 2014) as predictors of social status would be informative. Finally, prior work has shown that individuals with high psychiatric problem severity may especially benefit from involvement in AA, particularly from getting a sponsor and becoming involved in AA-related service (Subbaraman *et al.*, 2011). Studies should examine whether these factors are related to social status among AUD patients with psychiatric co-morbidities.

### Conclusions

Specialty addiction treatment alone is not sufficient to have positive long-term impacts on social status of alcohol-dependent people.

Recovery-oriented systems of care emphasize neighborhood-based delivery of services and development of community-based recovery support systems that provide ongoing, integrated services to prevent relapse (Sheedy and Whitter, 2009). These notions are consistent with paradigms encouraging a shift from a model of treatment as repeated episodes of acute care toward a model of chronic care focused on longer-term recovery management (White *et al.*, 2002, 2006). Implicit in these models is a need for ancillary support services during the protracted treatment and recovery process from addiction. Wraparound services, including educational, vocational and housing support, are effective (Institute of Medicine, 1990; McLellan *et al.*, 1998; Milby *et al.*, 1996) and recommended, but still are not yet commonly integrated into drug and alcohol treatment (Paino *et al.*, 2016). Employment and housing support services may have profound benefits for the social integration and social status of people with AUD, and the impacts may be particularly important for people with co-morbid drug or psychiatric problems.

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## CONFLICT OF INTEREST STATEMENT

None declared.

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