

Predictors of 16-Year Mortality Among Individuals Initiating Help-Seeking for an Alcoholic Use Disorder

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Background and Methods: We examined rates and predictors of mortality in individuals (47% women) who had just initiated help-seeking for their alcohol use disorders (AUDs) at the start of the study ($n = 628$) and were followed for 16 years.

Results: For both women and men, the observed-to-expected mortality ratio (1.4) was lower than rates found in samples of treated individuals with AUDs, suggesting that those initiating help-seeking careers have better chances of long-term survival. Of the individuals for whom cause of death was known, 68% died of alcohol-related causes. Men were more likely to die than were women. When gender was controlled, individuals who were older and unmarried and had more alcohol dependence symptoms at baseline were more likely to die over the 16-year period. When these baseline characteristics were controlled, better drinking outcomes at 1 year were associated with a lower likelihood of subsequent death. The combination of a shorter duration of inpatient/residential care and better drinking outcomes at 1 year was related to a lower probability of death, as was the combination of a longer duration of outpatient care or Alcoholics Anonymous attendance and better drinking outcomes at 1 year.

Conclusions: Efforts should be made to help providers identify individuals who are not responding positively to inpatient or residential treatment and intervene to motivate participation in continuing outpatient care and community 12-step self-help groups to reduce the likelihood of a chronic and fatal AUD course.

Key Words: Alcohol Use Disorder, Mortality, Gender, Treatment, Alcoholics Anonymous.

IT IS WELL documented that the course of alcohol use disorders (AUDs) may end in premature death (Rivara et al., 2004; Room et al., 2005). However, little is known about whether premature mortality risk is elevated among individuals who are relatively early in their alcohol careers and have initiated help-seeking. Further, although there is some evidence that remission may reduce the risk of premature mortality (Fillmore et al., 2003; Miller, 1999), there is little information about whether an initial course of professional treatment, or participation in Alcoholics Anonymous (AA), can counteract the connection between AUDs and heightened mortality risk.

To address these issues, we examined mortality in a sample of individuals who had just initiated help-seeking for their AUDs at the start of the study and were followed for

16 years. Specifically, we ascertained the proportions of women and men who died and how these rates compared with matched general population rates. We also identified baseline predictors of premature mortality. In addition, we focused on the extent to which help received during the first year of follow-up and better 1-year drinking outcomes were related to mortality during the next 15 years.

MORTALITY AMONG TREATED AND UNTREATED INDIVIDUALS WITH AUDS

Data on mortality are much more extensive for treated than for untreated individuals with AUDs. Finney and Moos (1991) reviewed long-term studies of mortality among treated individuals. Overall mortality rates ranged from 15% to 42% and were higher when the duration of follow-up was longer (see also Nielsen et al., 2005). To better compare data across studies, Finney and Moos (1991) calculated annualized mortality rates (i.e., the overall mortality rate divided by the number of years in the follow-up interval); these ranged from 1.6% to 3.6%. The review concluded that, when compared against general population data (usually adjusted for age and gender and sometimes adjusted for race and ethnicity), the observed mortality rate among individuals with AUDs is 1.6 to 4.7 times greater than expected.

Finney et al. (1999) conducted an updated review of long-term follow-up studies of individuals treated for

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AUDs. The results were generally consistent with those of the earlier review: 2.2% to 2.8% of patients died per year, and these rates were 2.6 to 3.6 times higher than expected. Subsequently, in studies of male alcoholic veterans followed for 5 to 14 years, the death rates were 2.5 times greater than that of a control group (Liskow et al., 2000) and 3.1 times higher than expected (Johnson et al., 2005).

Among individuals treated for AUDs, mortality rates were higher for men than for women (Feurerlein et al., 1994; Hurt et al., 1996). In addition, in community samples, rates of mortality due to alcohol use were higher in men than in women (John and Hanke, 2002; Zureik and Ducimetiere, 1996). Premature death due to alcohol abuse or dependence is particularly more likely among men than among women in young and middle-aged groups (Moller-Leimkuhler, 2003).

As to mortality in untreated samples of individuals with AUDs, Ojesjo (1981) found that 26% died over a 15-year follow-up, yielding an annual mortality rate of 1.7%. Vaillant (1996) found that 28% of his inner-city adolescent sample of alcohol abusing men died by age 60, as did 18% of alcohol-abusing men in his sample of university students. These rates are 2 and 3 times as high, respectively, as estimates for demographically similar general population groups. Here, we examine mortality rates separately for women and men in a sample of individuals with AUDs who had recognized their alcohol-related problems and had decided to initiate help-seeking.

PREDICTORS OF MORTALITY AMONG INDIVIDUALS WITH AUDs

Studies have examined severity of alcohol misuse as a predictor of premature death, but have focused less on other predictor domains, such as sociodemographic characteristics, life stressors, and social resources. It is important to determine associations of these domains with premature mortality because identification of individuals who are at particularly high risk of death will allow them to be targeted for interventions. In addition, identification of specific risk factors may suggest fruitful foci for interventions, particularly if findings show that risk of premature mortality is ameliorated by treatment.

Sociodemographic Characteristics

Among treated women and men with AUDs, older age was associated with premature death (Finney and Moos, 1992; Liskow et al., 2000; Mackenzie et al., 1986; Smith et al., 1983). Time to death was shorter among men than among women (Lewis et al., 1995). In addition, the risk of death is higher for individuals who do not have a spouse or partner (Johnson et al., 2005) and those with more medical problems (Finney and Moos, 1992; Finney et al., 1999; Liskow et al., 2000).

Severity of Alcohol Misuse

A more severe and longer duration of alcohol abuse predicts premature death (Liskow et al., 2000; Ojesjo, 1981). In Vaillant's (1996) study, men who met criteria for alcohol dependence were more likely to die prematurely than were men who met criteria for alcohol abuse. In an 11-year follow-up, Smith et al. (1983) found that women who developed their AUD early and engaged in binge drinking were more likely to die. Consistently, more alcohol consumption and having recognized at a younger age that drinking was a problem were related to more years of life lost to an AUD (Marshall et al., 1994). Finney's studies (Finney and Moos, 1992; Finney et al., 1999) similarly concluded that mortality risk is higher for persons exhibiting more severe alcohol abuse and dependence at treatment intake. Although severe and chronic AUDs are associated with greater mortality, nonproblem drinking has been found to be associated with a higher survival rate than abstinence, possibly because light or moderate alcohol consumption has beneficial health effects when other negative consequences of alcohol use are not present (Bridevaux et al., 2004; Harburg et al., 1994; Puddey et al., 1999). Reports of the beneficial effects of nonproblem drinking were not based on studies of help-seeking samples, however.

Social Context

The social context predicts treatment outcome (Timko et al., 2002), but less is known about social context and survival among individuals with AUDs. Finney and Moos (1992) found that individuals who were more socially isolated had a higher risk of mortality over 10 years. Liskow et al. (2000) reported that men who died had, at intake, poorer social functioning. In a study of older drinkers, severe interpersonal stressors and less participation in activities with friends were associated with increased mortality risk (Mertens et al., 1996).

HELP FOR AUDs, AUD OUTCOMES, AND MORTALITY

Prior studies have examined associations between receipt of help for alcohol problems and mortality. In inpatient care, Mackenzie et al. (1986) found that men who were hospitalized for AUDs more frequently were more likely to die over an 8-year follow-up. Inpatient treatment occurring throughout the course of alcoholism may be a marker for a more severe and chronic disorder because such treatment is sought in response to a relapse (Timko et al., 2000). In a study of inpatients with AUDs, de Lint and Levinson (1975) found that death rates were lower in the first 2 years postdischarge than thereafter. They speculated that intensive outpatient aftercare may delay or prevent the high rate of mortality that often occurs shortly after discharge. Among individuals treated for AUDs, those who subsequently attended AA were less likely to

have died by a 2-year follow-up than those who did not attend (Masudomi et al., 2004).

We examined associations between duration of help and mortality. For inpatient care, longer duration appears to be an indicator of greater disorder severity and thus should be associated with higher mortality. In this needs-based model, more treatment is often selected by and allocated to individuals with more severe problems (George and Tucker, 1996; Hajema et al., 1999; Kaskutas et al., 1997; Moos and Moos, 2004b; Tucker, 1995). However, for outpatient care and help from AA, a longer duration predicts better substance use disorder outcomes and so may indicate continuing motivation to stop drinking (Moos and Moos, 2003a, 2004a). From this perspective, a longer duration of outpatient treatment or AA affiliation should be associated with lower mortality.

Better AUD treatment outcomes are associated with lower mortality. Among treated men and women, those misusing alcohol at a 2-year follow-up had a death rate 2.2 times higher than expected 4 years later (Barr et al., 1984). In contrast, the rate was no higher than expected among patients who were not misusing alcohol at the 2-year follow-up. Among men treated for AUDs, relapse at 3 years after treatment was associated with excess mortality in the next 3 years (Yoshino et al., 1997). Similarly, among women treated for AUDs, those who were misusing alcohol 3 years posttreatment were more likely to have died 8 to 9 years later and then 10 years after that (Smith et al., 1983, 1994). Furthermore, those who relapsed after treatment were 3 to 5 times more likely to die as those who remained abstinent (Bullock et al., 1992; Feuerlein et al., 1994).

We examined whether help during Year 1 together with better 1-year drinking outcomes was associated with lower 16-year mortality. We expected that a combination of a longer duration of outpatient care or help from AA and better 1-year outcomes might be related to lower mortality. This combination reflects both continuing motivation to improve and success in achieving improvement. In contrast, in inpatient care, shorter and more successful treatment might be related to lower mortality. This is because, as noted, there are strong self-selection effects such that individuals with more serious disorders and relapses tend to obtain more inpatient care.

MATERIALS AND METHODS

Sample and Procedure

The participants were individuals with AUDs who, at baseline, had not received prior professional treatment for their disorder. These individuals had an initial contact with the alcoholism treatment system via information and referral (I&R) centers or detoxification (detox) programs (one was for women only) that were under contract to the counties in which they were located. Potential participants were screened by on-site staff to determine that they had never before received treatment. Among participants who contacted I&R centers, some were subsequently referred to treatment, and

among those seen at detox centers, some had on-site treatment services available (see Finney and Moos, 1995, for more details). Individuals who had never received professional AUD treatment before were eligible for the study, regardless of their status on subsequent treatment referral or availability (Finney and Moos, 1995). Data collection began in 1985 and ended in 2004.

After providing informed consent, 628 eligible individuals completed a baseline inventory described below (for more information about the initial data collection process, see Finney and Moos, 1995). Individuals who entered the study confirmed the lack of previous treatment and had an AUD as determined by one or more substance use problems, dependence symptoms, drinking to intoxication during the past month, and/or perception of alcohol abuse as a significant problem. At 1, 3, 8, and 16 years after entering the study, participants were located and contacted by telephone and asked to complete an inventory that was essentially identical to the baseline inventory. This study mainly uses data from the 1-year (82% response rate among those not known to have died) and 16-year (80% response rate among those not known to have died) follow-ups. The only significant differences between individuals who were or were not followed were that the participants followed were more likely to be women and to be employed at baseline ($p < 0.05$).

Specifically, the response rate at each follow-up was calculated as the percentage of the 628 individuals enrolled at baseline, minus the number not known to have died by the follow-up, who completed the follow-up inventory. To attain high follow-up rates, we adhered to established methods for locating and following individuals in longitudinal studies, including informing them at the baseline interview that follow-up evaluations would be conducted and when; obtaining the names, addresses, and phone numbers of at least 2 or 3 family members and/or friends with whom participants did not live; telling participants how to inform research assistants about changes in residence; and keeping detailed records of every effort to reach participants.

The 628 individuals were almost evenly divided between women (47.1%) and men (52.9%). Most were Caucasian (81.4%) or African American (6.8%), unmarried (79.0%), and unemployed (59.6%). On average, at baseline, these individuals were in their mid-30s (mean = 34.7; SD = 9.4) and had 13 years of education (mean = 13.1; SD = 2.3) and an annual income of \$12,225. They consumed an average of 13.1 oz of ethanol (SD = 11.2) on a typical drinking day, were intoxicated an average of 13.7 days (SD = 10.8) in the past month, and had an average of 3.9 dependence symptoms (SD = 6.8) and 3.8 drinking problems (SD = 6.1).

Measures

In addition to obtaining respondents' demographic and medical information, we assessed drinking patterns, life stressors, and social resources at baseline.

Medical Conditions. Medical conditions is the count of "yes" responses to 13 items, each indicating the presence of a chronic medical condition in the past year that was diagnosed by a physician (e.g., diabetes, high blood pressure, liver problems).

Drinking Patterns. At baseline, participants were asked how much wine, beer, and hard liquor they usually drank on the days during the past month that they drank each type of alcoholic beverage. Responses were coded as ounces of ethanol and then summed to obtain the amount of ethanol consumed on a typical drinking day. Drinking-related problems, drawn from the Health and Daily Living Form (Moos et al., 1990), were the sum of responses to a 5-point scale (0 = never, 4 = often) regarding how often in the past 6 months the respondent had each of 9 problems as a result of drinking (e.g., job, money, police) (Cronbach's $\alpha = 0.80$). Alcohol dependence symptoms, which were drawn from the Alcohol Dependence Scale (Skinner and Allen, 1982), were the sum of responses to the same 5-point scale regarding how often the respondent had each of 11 symptoms as a result of drinking (e.g., shakes when sobering up,

craving for a drink first thing when waking up) ($\alpha = 0.88$). Respondents also provided the age when they first recognized drinking as a problem.

Social Stressors and Resources. An adapted version of the Life Stressors and Social Resources (LISRES) Inventory (Moos and Moos, 1994) was used to assess this domain. Spouse/partner stressors ($\alpha = 0.81$) was the sum of 5 items (e.g., spouse disagrees on important issues), and friendship stressors ($\alpha = 0.73$) was the sum of 4 items (e.g., friends are critical or disapproving of you) rated on a 5-point scale (0 = never, 4 = often). Spouse/partner resources ($\alpha = 0.91$) was the sum of 10 items (e.g., count on spouse to help you), and friendship resources ($\alpha = 0.88$) was the sum of 6 items (e.g., friends really understand how you feel) rated on a 5-point scale (0 = never, 4 = often).

Drinking Outcomes

At each follow-up, respondents were categorized as to whether or not they were abstinent from alcohol during each of the past 6 months; had no drinking-related problems or one or more such problems; were relapsed or in remission (i.e., were either abstinent or met the following criteria: engaged in no, light, or moderate drinking during each of the past 6 months, drank 3 or fewer ounces of ethanol on drinking days that occurred during the past month, were never intoxicated during the past month, and had no drinking-related problems in the past 6 months); and had no symptoms of alcohol dependence or one or more such symptoms.

Participation in Professional Treatment and AA

At each follow-up, participants were asked, "Have you gone to anyone, anyone at all (a doctor, psychiatrist or psychologist, clergy or religious counselor, AA, detoxification unit, inpatient or outpatient treatment program, etc.) about your drinking habits or drinking-related problems since you completed our last questionnaire?" The month and year when the previous questionnaire was completed were provided. If participants answered "yes," they were asked to record the following information about each source of help: person, agency, or type of help; month and year; and number of weeks of help. Because treatment programs often include an AA component, participants were specifically instructed to record participation in treatment and AA separately. These data were used to determine the type and duration of help, if any, respondents obtained. There is support for the reliability and validity of self-reports regarding participation in substance abuse treatment (Adair et al., 1996; Golding et al., 1988) and in AA (Morgenstern et al., 1997; Tonigan et al., 2002).

Death Records

In attempting to locate a participant, when we discovered that the individual had died (e.g., a contact such as a spouse said the individual had died, or mail to the participant was returned and marked "deceased") or could not be located, we checked the National Death Index for a record of death and, if found, we requested a death certificate from the Department of Health (or Health Services) in the state of residence. We obtained death certificates for 107 of the 121 persons who died. Cause of death was recorded as unknown for 5 individuals.

RESULTS

Proportion of Individuals Initiating Help for AUDs Who Died

Of the baseline sample of 628 individuals, 121 were known to have died by the 16-year follow-up. The overall

16-year death rate was 19.3%, or 1.2% per year (i.e., the overall mortality rate divided by number of years in the follow-up interval).

Of 332 men, 72 died by the 16-year follow-up. The overall 16-year death rate for men was 21.7%, or 1.4% per year. Of 296 women, 49 died by the 16-year follow-up. The overall 16-year death rate for women was 16.6%, or 1.0% per year. Women had a significantly lower rate of death than did men ($\chi^2 = 3.56, p < 0.05$).

On average, the 121 persons who died were 48.9 years old at the time of death (range = 28–75 years old). The average number of months between baseline and death for those who died was 107 (8.9 years). Women and men who died did not differ on age at time of death or on number of months until death from baseline.

We examined how these mortality rates compared with demographically matched general population rates. Specifically, Kochanek and Smith (2004) presented data on deaths for the year 2002 in the United States. The age-adjusted death rate for persons of both genders and all races was 0.85%. Therefore, in this study, the overall observed to expected mortality ratio was 1.2 to 0.85 = 1.4. In 2002, the age-adjusted death rate for men (all races) was 1.01%, and 0.72 for women (all races) (Kochanek and Smith, 2004). Therefore, for both men and women, the observed-to-expected mortality ratio was 1.4.

For the 102 participants whose death certificate had a cause of death, we coded the cause as directly, indirectly, or not related to alcohol using the classification method published by the National Centre for Classification in Health (2004) and National Institute on Drug Abuse (NIDA, 1998). The classification method determines degree of alcohol death attribution based on extensive review of clinical case series studies, injury surveillance studies, and available epidemiologic investigations. Forty deaths were directly related to alcohol use (most commonly, cirrhosis or other liver disease), 29 were indirectly related to alcohol use (most commonly, coronary heart disease or suicide), and 38 were unrelated to alcohol use (most commonly, AIDS or lung cancer). Of the 102 individuals for whom cause of death was known, 68% died of causes related to alcohol use.

Baseline Predictors of Mortality

We conducted logistic regressions (controlling for gender) to predict whether participants died between baseline and the 16-year follow-up from 4 sets of indices at baseline: sociodemographics (including medical conditions), drinking patterns, social stressors, and social resources. The results are presented in Table 1.

In sociodemographics, older age, being unmarried, and having more medical conditions were associated with a higher likelihood of death. Analyses of drinking patterns at baseline showed that having more symptoms of alcohol dependence, and being older when drinking was first

Table 1. Baseline Predictors of Mortality (0 = Living, 1 = Dead) Between Baseline and the 16-Year Follow-Up (Controlling for Gender)

Predictor	Mortality	
	B	Odds ratio
<i>Sociodemographics</i>		
Age	0.072**	1.08
Marital status (0 = married, 1 = not)	0.676*	1.95
Medical conditions	0.280**	1.32
<i>Drinking patterns</i>		
Amount of ethanol on typical drinking day	0.015	1.02
Drinking-related problems	0.006	0.69
Dependence symptoms	0.044**	1.05
Age problem was recognized	0.039**	1.04
<i>Social stressors</i>		
Spouse/partner	-0.004	1.00
Friends	0.088*	1.09
<i>Social resources</i>		
Spouse/partner	-0.031*	0.97
Friends	-0.047*	0.95

**p* < 0.05.
 ***p* < 0.001.

recognized as a problem, were also associated with a higher likelihood of dying. More friends stressors at baseline were associated with death, as were fewer spouse/partner and friends resources.

We conducted a logistic regression analysis to identify independent predictors of death from the significant baseline predictors in Table 1, controlling for gender. Being older (*B* = 0.087, *p* < 0.001) and unmarried (*B* = 0.884, *p* < 0.01) and having more alcohol dependence symptoms (*B* = 0.048, *p* < 0.01) were independently related to a higher likelihood of death ($\chi^2 = 52.20$, *p* < 0.001).

Help for AUDs in Year 1 and Subsequent Mortality

Duration of help (i.e., number of weeks) obtained during the first year of the follow-up was assessed for inpatient or residential treatment, outpatient treatment, and AA. We conducted logistic regressions (controlling for gender, age, marital status, and alcohol dependence symptoms at intake) to examine associations between duration of each type of help obtained in the first year and mortality in the subsequent 15 years. To consider relatively broad and distinct groups, participants were classified into 4 categories based on the number of weeks they received each type of help. Specifically, these categorizations were based on those of Moos and Moos (2003a, 2004a), who utilized typical designations of brief, moderate, and long-term help and empirical distributions of the duration of help. First, participants were classified into 4 groups based on the number of weeks of inpatient/residential treatment they received during Year 1: none (67%), up to 3 weeks (9%), 3 to 12 weeks (13%), or more than 12 weeks (11%). Participants were then classified into 4 groups based on the number of weeks of outpatient treatment they received during Year 1: none (62%), up to 8 weeks (13%), 8+ to 26

weeks (12%), and more than 26 weeks (13%). Finally, participants were classified into 4 groups based on the number of weeks they attended AA meetings during Year 1: none (43%), up to 16 weeks (20%), 16+ to 32 weeks (18%), and more than 32 weeks (19%).

When baseline sociodemographic characteristics and alcohol dependence were controlled, duration of inpatient/residential treatment, outpatient treatment, and AA attendance did not predict likelihood of death. In follow-up analyses, we found that continuous measures of the duration of inpatient/residential treatment, outpatient treatment, and AA also did not predict likelihood of death.

One-Year AUD Outcomes and Subsequent Mortality

We conducted logistic regressions (controlling for gender, age, marital status, and alcohol dependence symptoms at intake) to predict mortality between 1 and 16 years from drinking-related outcomes at 1 year. A lower likelihood of death was significantly predicted by, at 1 year, having no drinking-related problems (*B* = 0.662, *p* < 0.01), being in remission (*B* = 0.634, *p* < 0.01), and having no dependence symptoms (*B* = 0.570, *p* < 0.05) and marginally predicted by abstinence (*B* = 0.485, *p* < 0.08).

One-Year Help for AUDs, 1-Year Drinking Outcomes, and Mortality

We conducted logistic regression analyses (controlling for gender, age, marital status, and dependence symptoms at baseline) in which predictors were the duration of help in the first year (inpatient/residential, outpatient, or AA), drinking outcomes at 1 year (abstinence, drinking-related problems, remission, or alcohol dependence symptoms), and the interaction between the duration of help and the 1-year outcome; the criterion was mortality between 1 and 16 years. When number of weeks of inpatient/residential treatment was used as a predictor, poorer 1-year drinking outcomes (i.e., not achieving abstinence, having drinking-related problems, being unremitted, and having alcohol dependence symptoms) were associated with a greater likelihood of death (Table 2). There were significant interactions between duration of inpatient/residential treatment and the outcomes of drinking problems and remission in the prediction of mortality. Plotting the interactions showed that the combination of a shorter duration of inpatient/residential treatment during Year 1 (i.e., less than 3 weeks) and having no drinking-related problems, or being remitted, at the 1-year follow-up, was associated with a lower likelihood of death between 1 and 16 years than was the combination of a shorter inpatient/residential stay and poor outcome or a longer stay and the presence or absence of poor outcome.

When weeks of outpatient treatment was used, the alcohol-related outcomes of not achieving abstinence, having drinking problems, being unremitted, and having

Table 2. Logistic Regressions Predicting Mortality at 16 Years (0 = Living, 1 = Dead) from Duration of Help, 1-Year Alcohol Outcomes, and Their Interactions

Type of help	Mortality at 16 years			
	Model 1 (not abstinent at Year 1)	Model 2 (drinking problems at Year 1)	Model 3 (not remitted at Year 1)	Model 4 (dependence symptoms at Year 1)
<i>Inpatient/residential</i>				
Weeks of help	-0.019	0.113	0.067	0.070
1-year outcome	0.640*	0.763**	0.876**	0.653*
Interaction of help and outcome	-0.286	-0.464*	-0.448*	-0.374
<i>Outpatient</i>				
Weeks of help	-0.032	-0.014	-0.064	-0.080
1-year outcome	0.482*	0.682**	0.730**	0.584*
Interaction of help and outcome	0.324	0.420*	0.372	0.364
<i>Alcoholics Anonymous</i>				
Weeks of help	-0.286*	-0.388*	-0.300*	-0.328*
1-year outcome	0.428	0.670**	0.701**	0.587*
Interaction of help and outcome	0.679**	0.759**	0.629**	0.590**

* $p < 0.05$.** $p < 0.01$.

For each drinking outcome, 0 = better outcome, 1 = poorer outcome.

dependence symptoms remained significant predictors of mortality. There was a significant interaction between duration of outpatient treatment and drinking-related problems in the prediction of mortality. In this case, the combination of a longer duration of outpatient treatment (more than 8 weeks) and having no drinking-related problems at the 1-year follow-up was associated with a lower likelihood of death between 1 and 16 years than were the other combinations.

The results of the logistic regressions using weeks of AA during the first year as a predictor were that the alcohol-related outcomes of drinking problems, nonremitted status, and dependence symptoms remained significant predictors of mortality. In this context, a longer duration of participation in AA was associated with a lower likelihood of mortality. In addition, there were significant interactions between duration of AA during the first year and all four 1-year drinking outcomes on mortality between 1 and 16 years. For each interaction, participants who had both a longer duration of AA (more than 16 weeks) and a better drinking outcome at the 1-year follow-up were less likely to die. For example, among participants with both a longer duration of AA and remission, 13% died between the 1 and 16-year follow-ups, versus 23% of participants with both a longer duration of AA and nonremission, 19% of those with a shorter duration of AA and remission, and 18% of those with a shorter duration of AA and nonremission.

Subsidiary Analyses

To supplement the analyses presented above, we examined mortality based on participants' 1-year drinking status as abstinent, nonproblem drinking, or problem drinking. Because participants' health and drinking status may have changed after the 1-year follow-up, we also

focused on associations of help and drinking outcomes at the 3- and 8-year follow-ups with subsequent mortality.

One-Year Drinking Status and Mortality. To consider whether abstinence, nonproblem drinking, or both were associated with reduced mortality compared with problem drinking, we classified participants' drinking status into 3 groupings at 1 year: abstinent (36%), nonabstinent but had no drinking-related problems (15%), or problem drinkers (consumed alcohol and had at least 1 drinking-related problem, 49%). We conducted a logistic regression predicting death between 1 and 16 years from drinking status group (controlling for baseline variables). Drinking status group at 1 year predicted mortality ($B = 0.327$, $p < 0.05$) at 16 years such that abstinent individuals were less likely to die than problem drinkers. Nonproblem drinkers were marginally less likely to die than were problem drinkers ($p < 0.10$).

Help and Outcomes in Years 2 to 3 and Subsequent Mortality. Of the 121 participants known to have died, 93 did so after the 3-year follow-up. We conducted logistic regressions (controlling for intake variables) to examine associations between duration of each type of help obtained in Years 2 to 3 (as before, participants were classified into 1 of 4 duration groups for each help type) and mortality in the subsequent 13 years. When baseline characteristics were controlled, outpatient treatment and AA attendance did not predict likelihood of death, but a longer duration of inpatient/residential treatment did ($B = 0.247$, $p < 0.05$).

We also conducted logistic regressions (controlling for intake variables) to predict mortality between 3 and 16 years from drinking-related outcomes at 3 years. A lower likelihood of death was significantly predicted by, at 3 years, having no drinking-related problems ($B = 0.628$, $p < 0.05$), being in remission ($B = 0.557$, $p < 0.05$), having no dependence symptoms ($B = 0.933$, $p < 0.05$), and

abstinence ($B = 0.707$, $p < 0.05$). However, there were no significant interactions between duration of any type of help in years 2 to 3 and the 3-year outcomes in predicting mortality.

We then conducted logistic regression analyses controlling for intake characteristics and 3-year drinking outcomes, to predict mortality between 3 and 16 years from 1-year drinking outcomes. A lower likelihood of death was significantly predicted by, at 1 year, having no drinking-related problems ($B = 0.879$, $p < 0.01$), being in remission ($B = 0.529$, $p < 0.05$), and having no dependence symptoms ($B = 0.653$, $p < 0.05$), even when the corresponding 3-year drinking outcome was included as a predictor. Thus, 3-year drinking outcomes did not fully account for relationships between 1-year outcomes and subsequent mortality.

Help and Outcomes in Years 4 to 8 and Subsequent Mortality. Of the 121 participants known to have died, 76 did so between the 8- and 16-year follow-ups. Parallel to previous analyses, we conducted logistic regressions (controlling for intake variables) to examine associations between duration of each type of help obtained in Years 4 to 8 and mortality in the subsequent 8 years. When baseline characteristics were controlled, duration of inpatient/residential treatment, outpatient treatment, and AA attendance did not predict likelihood of death. Also, there were no significant interactions between duration of any type of help in years 4 to 8 and the 8-year outcomes in predicting mortality.

DISCUSSION

The observed-to-expected mortality rate in this sample of individuals who had just initiated help-seeking for their AUDs was 1.4 for both women and men. This rate is lower than rates found in samples of treated individuals with AUDs, many of whom have recurrent episodes of treatment (Finney and Moos, 1991; Finney et al., 1999). This suggests that individuals who are just beginning their help-seeking careers have a better chance of long-term survival than do women and men with more chronic disorders. That is, individuals entering an initial episode of help-seeking may be successful at preventing or reducing the harm associated with excessive drinking that is also potentially causal in death. In contrast, repeated episodes of AUD treatment are often a reflection of the chronic and severe alcoholism known to cause premature death. As other studies have found, men were more likely to die than were women (Feurerlein et al., 1994; Hurt et al., 1996; John and Hanke, 2002; Zureik and Ducimetiere, 1996). Of the individuals who died, over two-thirds died of causes related to alcohol use.

Predictors of Mortality

When gender was controlled, individuals who were older and had more alcohol dependence symptoms (Finney and

Moos, 1992; Liskow et al., 2000) and were unmarried were more likely to die over the 16-year observation period. Alcohol-related mortality tends to be lower among married persons (Agren and Romelsjo, 1992; Lewis et al., 1995), most likely because getting married is associated with reduced alcohol consumption over time (Miller-Tutzauer et al., 1991; Temple et al., 1991). In contrast, individuals who never marry have a more chronic heavy alcohol consumption pattern that may contribute to their increased mortality (Power et al., 1999).

In addition, we found that better 1-year drinking outcomes were associated with a lower mortality rate in the subsequent 15 years. As reviewed by Miller (1999), abstinence, particularly continuous abstinence, had a positive effect on the survival of individuals with AUDs. Studies comparing stable abstinence with reduced frequency and quantity of abusive drinking found that only stable abstinence prevented a higher mortality risk (Bullock et al., 1992; Gerdner and Berglund, 1997). Our results are consistent with those findings in that nonproblem drinking only marginally reduced the likelihood of death, whereas abstinence or a complete absence of drinking-related problems or alcohol dependence symptoms was associated with a lower mortality rate in comparison with problem drinking or having at least 1 problem or symptom.

The combination of a short duration (less than 3 weeks) of inpatient/residential treatment during Year 1 and having no drinking-related problems, or being remitted, at the 1-year follow-up, was associated with a lower likelihood of death between 1 and 16 years. These results agree with Barr et al.'s (1984) observation that when inpatient treatment does not succeed in modifying an AUD patient's drinking behavior, the patient has a higher risk of subsequent death. Other studies noted that mortality rates tend to be higher among substance use disorder patients receiving help in extended care settings, possibly because treatment in extended care reflects the patient's more severe medical problems and lack of socioeconomic resources (Combs-Orme et al., 1988; Lindberg and Agren, 1988; Moos et al., 1994).

We also found that the combination of a longer duration of outpatient treatment (more than 8 weeks) and having no drinking-related problems at the 1-year follow-up was associated with a lower likelihood of subsequent death. Previous studies found that more outpatient care was associated with lower mortality rates in samples of men with AUDs (Kristenson et al., 2002; Noda et al., 2001) and substance use disorder patients (Moos et al., 1994). Successful treatment may delay the medical consequences of AUDs, which may explain associations between obtaining treatment and reduced mortality (Holder and Parker, 1992; Miller, 1999). Our results suggest that both longer outpatient treatment and an early elimination of, or solution to, drinking-related problems may be necessary to reduce the subsequent likelihood of death among alcoholic patients.

In the same vein, a longer duration of AA attendance during the first follow-up year (specifically, attendance for more than 4 months) combined with better 1-year drinking outcomes was associated with a lower likelihood of death in the subsequent 15 years. Previous studies have shown either the benefits of 12-step group attendance on substance use outcomes ([Christo and Franey, 1995](#); [Emrick et al., 1993](#); [Fiorentine, 1999](#); [Gillet et al., 1991](#); [Miller et al., 1997](#); [Ouimette et al., 1999](#); [Weiss et al., 2005](#)) or of better drinking outcomes on reduced mortality ([Barr et al., 1984](#); [Bullock et al., 1992](#); [Feurerlein et al., 1994](#); [Fillmore et al., 2003](#); [Smith et al., 1983](#)). [Crits-Christoph et al. \(2003\)](#) suggested that, over time, causation between more 12-step group involvement and better substance use outcomes may be reciprocal; that is, increases in involvement may produce an initial reduction in substance use, which in turn produces an increase in involvement. Alcoholics Anonymous participation may delay mortality not only by reducing drinking and drinking-related, including medical, problems, as outpatient treatment does, but also by increasing social resources and reducing friendship stressors ([Humphreys and Noke, 1997](#); [Kaskutas et al., 2002](#); [Masudomi et al., 2004](#)).

Limitations and Conclusions

It is important to clarify the limitations as well as the strengths of the research design. This study used a naturalistic, self-selection design rather than a randomized clinical trial (RCT) design ([Seligman, 1995](#)). Accordingly, the associations between the duration of help and mortality may be due to self-selection as well as any effects of participation in professional treatment or AA. Nevertheless, the primary strengths of naturalistic studies are their realism and external validity, and thus our findings probably are an accurate reflection of associations of inpatient/residential and outpatient treatment and self-help with mortality risk. Moreover, naturalistic and RCT designs have reported comparable outcomes of self-selected and randomly assigned substance use disorder patients ([McKay et al., 1998](#); [Moyer and Finney, 2002](#); [Westerberg et al., 2000](#)).

Another limitation is that, because the I&R and detox programs were under county contracts, the findings may not generalize to private-sector populations, especially those in for-profit settings, who are likely to have more economic and social resources and less severe disorders than are public-sector clients ([Rodgers and Barnett, 2000](#); [Wheeler and Nahra, 2000](#); [Wheeler et al., 1992](#)). However, because public programs are less likely than for-profit programs to limit access to care by turning clients away ([Friedman et al., 2003](#)), our findings may generalize more broadly than if individuals had been recruited from private-sector sites.

Finally, the validated method that we used for coding the extent to which cause of death was related to alcohol

misuse relied on death certificates for cause of death. However, processes for entering cause of death on death certificates may not be standardized across states or even local jurisdictions within states ([Gossop et al., 2002](#); [NIDA, 1998](#)). The method for coding cause of death as attributable to alcohol will need to be updated as new information becomes available. In particular, the role of alcohol in death from cardiovascular disease is still not fully understood. For example, the suggested J-shaped function of risk for coronary heart disease indicates that alcohol intake is both causal and preventive and risk may differ between wine and other alcoholic beverage drinkers ([Cipriani et al., 1998](#)). In addition, although recent studies categorized deaths from AIDS as due to medical causes rather than substance misuse ([Gossop et al., 2002](#)), more work is needed to determine the extent to which deaths caused by AIDS-related diseases involve alcohol misuse ([NIDA, 1998](#)).

Even after participants' personal characteristics at baseline were considered, a longer duration of inpatient/residential treatment and either good or poor drinking outcomes 1 year later predicted higher mortality in the subsequent 15 years. Efforts should be made to help referral counselors and treatment providers identify individuals whose drinking, medical, and other problems do not respond positively to inpatient treatment and intervene to reduce the likelihood of a chronic and fatal course of their AUD. Efforts should also be made to find effective methods for retaining outpatients in treatment, and sustaining AA participation among individuals with AUDs, even when they appear to be responding well in the short term. As set forth by [Moos \(2005\)](#) and [Moos and Moos \(2003b\)](#), such interventions may involve increased therapeutic bonding and monitoring, decreased reliance on confrontation and high emotional arousal, and increasing the level of expectations and challenge in the treatment setting ([Timko and Sempel, 2004](#); [Timko et al., 1993](#)).

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