Effects of Age and Life Transitions on Alcohol and Drug Treatment Outcome Over Nine Years

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ABSTRACT. Objective: The purpose of this study was to examine the effects of age, common life transitions, treatment, and social support on outcomes 5–9 years after alcohol and other drug (AOD) treatment intake. **Method:** Participants were patients from a large outpatient AOD treatment program in an integrated health plan. There were 1,951 participants interviewed at intake, of whom 1,646 (84%) completed one or more telephone follow-up interviews at 5, 7, and 9 years. Measures included AOD use based on the Addiction Severity Index; treatment; and changes in marital, employment, and health status in the years between each follow-up. We compared participants by age group (18–39, 40–54, and ≥55 years old at intake) and examined factors (time invariant and time varying) associated with outcomes at 5, 7, and 9 years by fitting mixed-effects logistic random intercept models. **Results:** Changes in marital,

employment, and health status varied significantly by age. Factors associated with remission across Years 5–9 included being in the middle-aged versus younger group ($p < .001$); female gender ($p < .001$); not losing a partner to separation, divorce, or death ($p < .001$); not experiencing a decline in health ($p = .021$); having any close friends supportive of recovery ($p < .001$); and not having any close friends who encourage AOD use ($p < .001$). Additional predictors, including employment changes, varied by drug versus alcohol abstinence outcome measures. **Conclusions:** Negative life transitions vary by age and are associated with worse outcomes. Older age and social support are associated with long-term AOD remission and abstinence. Findings inform treatment strategies to enhance recovery across the life span. (*J. Stud. Alcohol Drugs*, 73, 459–468, 2012)

THE LIFE COURSE PERSPECTIVE IS EMERGING as a powerful organizing framework in understanding long-term alcohol and other drug (AOD) treatment outcomes and has a promising role in shaping effective interventions. Although primarily conducted in general population samples, studies show that, as individuals move through life, they experience transitions that influence the course of recovery (Dawson et al., 2006). In the general population, younger adults often mature out of AOD problems as they take on adult roles such as employment and stable relationships (Fillmore, 1987; Fillmore and Midanik, 1984; Fillmore et al., 1979; Neve et al., 2000). This is consistent with life span theories such as Erikson's stage model (Erikson, 1963), in which maturation is associated with identity formation, building relationships, and other developmental tasks. On the other hand, stress and coping models have identified the potential adverse effect of negative transitions (Allan and Cooke, 1985)—for example, separation, divorce, and widowhood have been associated with increases in drinking (Caces et al., 1999; Perreira and Sloan, 2001; Zisook et al., 1990)—

although effects may differ by gender (Walitzer and Dearing, 2006; Wilsnack et al., 1991). For example, the death of a spouse may lead to an increase in drinking among older men but not among older women (Perreira and Sloan, 2001). This suggests gender-based differences in underlying processes, such as varying grief response or influence of a partner's drinking, that affect the course of recovery over time.

Maturation may also be associated with increasing awareness of the negative impact of substance use on health. In general population studies of older adults, increasing health problems over time also may motivate reduced drinking among both men and women (Moos et al., 2005; Satre et al., 2007). This is consistent with longitudinal findings in our sample that medical conditions at baseline through 1 year were predictive of remission at 5 years (Mertens et al., 2008). Thus, we proposed to examine the long-term impact on treatment outcomes of health changes and other life stressors, including age group differences in these relationships.

Research among adults in AOD treatment has found associations between older age and better outcomes (Hser et al., 1997; Lemke and Moos, 2003)—for example, that adults ages 55 and older at baseline have higher abstinence rates than younger adults at 5 years (Satre et al., 2004). Factors associated with both older age and better outcomes included being dependent on alcohol only or being nondependent (vs. being dependent on drugs or both alcohol and drugs), having a longer length of stay in treatment, and having social sup-

Received: October 19, 2011. Revision: December 29, 2011.

This research was supported by National Institute on Alcohol Abuse and Alcoholism Grants R37 AA10359 and R01 AA020463 and National Institute on Drug Abuse Grants R01 DA10572 and P50 DA009253.

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port conducive to abstinence (Satre et al., 2004). However, prior studies have not examined the distribution and impact of factors predictive of long-term outcomes by age group in treatment samples.

The current study incorporated the life span approach into a theoretical model conceptualizing long-term AOD outcome as influenced by individual characteristics (demographic factors and AOD diagnosis), treatment (index length of stay and readmission), and extra-treatment factors (recovery oriented vs. substance-using members of patients' social network) (Satre et al., 2004), as well as life transitions such as experiencing changes in marital, employment, and health status (Dawson et al., 2006; Hser et al., 2006; Xie et al., 2010). We examined the frequency of these transitions by age group across time. We anticipated that (a) becoming married/partnered or employed, particularly for young adults, would predict better AOD outcomes, whereas becoming separated/divorced/widowed or unemployed, particularly in middle age and older adults, would predict worse outcomes and (b) declines in health, especially among older adults, would predict better outcomes. Longitudinal methodology allows us to examine the impact of these factors as time-varying covariates across multiple time points 5–9 years following treatment intake.

We examined remission to nonproblematic substance use in addition to abstinence. Because AOD disorders tend to be chronic, relapsing conditions (McLellan et al., 2000), investigating factors predictive of remission and abstinence over time in a treatment sample can inform effective intervention strategies. Examining patterns by age group has the further potential to shape treatment and aftercare based on patient age at intake and to address challenges that patients are likely to face after treatment.

Method

Participants

Participants were 1,646 men and women drawn from two large, randomized studies conducted at the Kaiser Permanente Chemical Dependency Recovery Program in Sacramento, California. The first study compared day hospital with traditional outpatient treatment and recruited patients between 1994 and 1996 ($n = 1,204$) (Weisner et al., 2000). The second study examined integrated delivery of medical and AOD services, and recruited patients between 1997 and 1998 ($n = 749$) (Weisner et al., 2001). These studies were conducted in the same abstinence-based program, in which patients received either day hospital or outpatient treatment. Most participants were randomized by treatment intensity or chose one option based on factors such as their employment schedule. Program components were consistent across both studies.

We used an "intent-to-treat" design, including all those

recruited at intake, whether they agreed to be randomized or actually began treatment. Institutional review board approval was obtained from the Kaiser Research Foundation Institute and the University of California, San Francisco. Patients were included in 9-year follow-up regardless of whether they remained members of the health plan.

Alcohol and other drug treatment program

Kaiser Permanente Northern California is a large (3 million membership), private, nonprofit, integrated health care delivery system. AOD services are provided internally rather than through external contracts. Patients with dementia, mental retardation, or active psychosis were not eligible. Sessions included supportive group therapy, education, relapse prevention, and family-oriented therapy. Individual counseling, physician appointments, and pharmacotherapy were available as needed (although data on specific types of services received are not available). Patients received random breath alcohol analysis and urine screens (Weisner et al., 2000). This treatment approach is similar to other group-model private and public programs (Institute of Medicine, 1990).

The rehabilitation phase for both day hospital and outpatient treatment lasted 8 weeks. During the first 3 weeks, day hospital patients attended daily for 6 hours; in the outpatient program, patients attended a 1.5-hour session 3 days per week. During Weeks 4–8, the programs had similar treatment intensity (four 1.5-hour sessions in day hospital and three 1.5-hour sessions in traditional outpatient). Aftercare began the ninth week and consisted of one outpatient session per week for 10 months. Patients were considered to have dropped out if they missed 7 continuous days during the first 8 weeks (i.e., the rehabilitation phase) or 30 continuous days after the first 8 weeks (i.e., during aftercare), based on attendance data from Kaiser Permanente's outpatient visit registration database (Weisner et al., 2001). There were no age differences in assignment to treatment condition, and we controlled for treatment condition in the models.

Measures

Demographics and health. Demographic variables derived from the baseline interview included age group (18–39, 40–54, and 55 years and older), gender, ethnicity (White, African American, Hispanic, other), education, and income (less than \$40,000 per year or at least \$40,000 per year). Variables measured at baseline and follow-ups included employment status (currently employed vs. unemployed), marital status (currently married or living as married vs. separated, divorced, or widowed), and health status using the question, "In general, would you say your health is excellent, very good, good, fair, or poor?" Health status was dichotomized for analysis (excellent, very good, or good vs. fair or poor) (Bierman et al., 1999).

Alcohol and other drug use. AOD use measures were based on an abbreviated form of the Addiction Severity Index. This version comprises all questions in the Addiction Severity Index composite scales. Validity and reliability have been found across patient age ranges (McLellan et al., 1992). Self-report measures of AOD use have been validated, and this has been found for older adults as well (Tucker et al., 1991). Patient self-reported abstinence was validated with urinalysis and breathalyzer testing (Weisner et al., 2000). Comparison analyses conducted at 6 months suggested good validity of self-report data, with agreement rates of 93.4%. The percentage of participants who tested negative for all substances, but who reported having used one or more substances, was only 2.5% for one study (Weisner et al., 2000) and ranged from 0.9% (barbiturates) to 5.8% (marijuana) for the other study (Weisner et al., 2001). We did not recode self-report data that were inconsistent, but prior studies have found similar results when replicating models among those whose urinalysis results were consistent with self-report data (Weisner et al., 2001).

To assess AOD dependence at treatment entry, we used a checklist to provide a diagnosis for alcohol and drug (11 substance types) dependence according to criteria from the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision* (American Psychiatric Association, 2000). For each substance, we established whether three of seven dependence symptoms were present during the previous 30 days (Weisner et al., 2000, 2001). We classified patients as alcohol dependent, drug dependent, both drug and alcohol dependent, or nondependent.

Services. Length of index AOD treatment episode was measured in weeks. Readmissions within Kaiser Permanente were identified using Kaiser Permanente's automated administrative data and defined as having at least three visits (with no more than 30 days gap between each visit) to a program during 2–9 years after intake (Mertens et al., 2005). For those who lost Kaiser Permanente membership, readmissions outside Kaiser Permanente were captured via patient self-report from the follow-up interviews. Dichotomous measures were created indicating any readmission episode within or outside Kaiser Permanente in Years 2–5, 6–7, and 8–9.

Social support. We used questions developed to assess relationships conducive to and detracting from recovery (Kasckas, 1995). We asked each patient to estimate the number of people he or she associates with who (a) actively support the patient's efforts to reduce his or her drinking or drug use or (b) encourage alcohol or drug use. Because responses to this second question were highly skewed, with 85% of the sample responding "0," both measures were dichotomized for analysis (0 vs. ≥ 1). These variables have been predictive of abstinence (Weisner et al., 2003). Because past studies have indicated that older adults may be less likely than younger adults to use 12-step groups (Satre et al., 2004),

we also asked participants to indicate the number of 12-step meetings they attended in the prior year.

Outcomes. The primary AOD outcome was prior-year remission, measured at 5, 7, and 9 years. Remitted individuals were those who either reported abstaining in the past year or those who were non-problem users as follows: They (a) used alcohol but had no days of drinking five or more drinks in a day and drank only four times per month or less in the past year, or used marijuana but not more than once per month in the past year; (b) had no other drug use in the past year; (c) had no problems with friends or family, violent behavior, or suicidal ideations in the month before the interview; and (d) had not been arrested, in jail/prison, under electronic home surveillance, or to a probation or parole officer in the year before the interview (Mertens et al., 2008). This is consistent with other "remission" definitions (Moos and Moos, 2003). Additional outcomes included abstinence from either alcohol or drugs during the prior year.

Procedures

Patients completed an in-person baseline interview at AOD treatment intake. Interviewers explained the study, asked participants to accept random assignment, and obtained informed consent. Research staff conducted follow-up telephone interviews from the Kaiser Permanente Division of Research in Oakland, CA, 1, 5, 7, and 9 years after intake for all individuals who completed baseline interviews. Interview data were linked to treatment records in the health plan. At 9 years, follow-up rates among living participants were 73.7% for the day hospital study and 76.8% for the integrated care study.

Data analyses

Participants were divided into three age groups: younger than 40 years, 40–54 years, and 55 years and older at baseline, as in previous studies (Lemke and Moos, 2003; Satre et al., 2004). Age group differences in baseline characteristics; weeks of treatment; treatment readmission; social support measures; and AOD outcomes at 5, 7, and 9 years were examined using chi-square tests and analysis of variance. Bivariate outcomes were examined separately by gender to investigate primary AOD outcomes among age-gender subgroups. Comparisons between age groups were adjusted to $p < .01$ because of multiple comparisons.

Variables were created indicating changes in marital, employment, and health status since the last interview at 5, 7, and 9 years: marital status (becoming married, becoming separated/divorced/widowed, remaining the same), employment (becoming employed, becoming unemployed, remaining the same), and health status (improving, worsening, remaining the same based on the dichotomized self-report measure). Becoming separated, divorced, or widowed were

grouped together because too few participants reported these events to examine their effects separately. Age group differences at 5, 7, and 9 years in these change variables were also examined by chi-square tests.

We examined factors associated with AOD outcomes at 5, 7, and 9 years by fitting mixed-effects logistic regression models with a random intercept, using data of those who completed at least one telephone interview at these follow-up time points ($N = 1,646$). Of the 1,646, 1,195 (72.6%) completed all three follow-up interviews, 240 (14.6%) completed two, and 211 (12.8%) completed only one. At each follow-up, all baseline participants would be contacted regardless of their interview status at the prior time point. We note that a key advantage of the mixed-effects modeling approach is that it can be applied when participants are not measured at the same number of time points, making casewise deletion unnecessary. Estimators are valid under the assumption of missing at random.

The mixed-effects logistic random intercept models examined the effects of the explanatory variables on the participants' probability of being remitted (or abstinent from alcohol or drug use) while allowing the initial status (i.e., intercept) to vary for every subject. Time-invariant covariates included age group, gender, education, ethnicity, substance diagnosis at baseline, and index treatment length. Time-varying covariates at 5, 7, and 9 years included time

(coded as 0, 2, 4 at 5, 7, and 9 years); re-admission to AOD treatment received between follow-ups; variables indicating changes in health, marital, and employment status from prior interview; and social support. Treatment condition (day hospital vs. usual outpatient) was included to control for treatment intensity. Modeling for each outcome (past-year remission, past-year alcohol abstinence, and past-year drug abstinence) was conducted in two steps. First, we ran a model including only main effects of the covariates. Second, we ran models examining interactions between age group and gender (because previous analysis of earlier follow-up points indicated that gender effects on AOD use outcomes may be stronger in older adults than among younger adults) (Satre et al., 2004), followed by age and readmission to AOD treatment; age and changes in health, marital, and employment status from prior interview; and age and social support, adjusting for main effects. We examined each set of the interactions individually and then ran a model including all interaction terms significant at $p < .10$ in individual models. Analyses were conducted using SAS Version 9.1 (SAS Institute Inc., Cary, NC).

Results

Compared with participants not followed at 5, 7, and 9 years and thus not included in the study sample ($n = 305$),

TABLE 1. Baseline demographic characteristics, substance diagnoses, and treatment utilization measures, by age group ($N = 1,646$)

Variable	Age group at baseline			χ^2 or F
	Age 18–39 ($n = 990$)	Age 40–54 ($n = 559$)	Age ≥ 55 ($n = 97$)	
Gender, %				6.5*
Male	60.3	64.9	71.1	
Female	39.7	35.1	28.9	
Married/partnered, %	37.8	53.2	59.8 ^{a,c}	44.3***
Ethnicity, %				23.5***
White	73.6	71.9	89.7 ^{a,b}	
Black	10.5	14.6	4.1	
Hispanic	9.7	9.9	3.1	
Other	6.2	3.6	3.1	
Education, %				69.4***
Some college	30.1	51.4	44.2 ^c	
High school	52.8	39.4	43.2	
<High school	16.7	9.2	12.6	
Employed, %	57.8	69.6	34.4 ^{b,c}	49.6***
Diagnosis, %				217.8***
Alcohol only	28.3	54.9	78.4 ^{a,b,c}	
Drug only	39.4	17.9	4.1	
Alcohol and drug	22.7	12.9	3.1	
Criteria not met	9.6	14.3	14.4	
Health status, %				0.5
Excellent/very good/good	72.5	70.8	71.1	
Fair/poor	27.5	29.2	28.9	
Weeks of treatment, M (SD)	7.8 (12.2)	12.7 (16.5)	13.7 (17.6) ^{a,c}	24.8***

Notes: Sample includes all patients who completed one or more follow-up interviews at 5, 7, or 9 years.

^aSignificant difference between participants ages ≥ 55 and ages 18–39 at baseline, $p < .01$; ^bsignificant difference between participants ages ≥ 55 and ages 40–54 at baseline, $p < .01$; ^csignificant difference between participants ages 40–54 and ages 18–39 at baseline, $p < .01$.

* $p < .05$, *** $p < .001$.

those in the study sample were younger ($M_{\text{age}} = 37.1$ years, $SD = 10.6$, vs. 39.3 years, $SD = 11.8$, $p < .001$), were more likely to be female (37.5% vs. 31.2%, $p = .035$) and employed at baseline (60.5% vs. 52.6%, $p = .011$), and stayed longer in the index AOD treatment (9.8 weeks, $SD = 14.4$, vs. 6.2 weeks, $SD = 11.2$, $p < .001$) (not shown). These factors were included as covariates in the models.

Compared with adults ages 18–39, adults ages 55 and older at intake were more likely to be married or partnered, White, not employed, and alcohol dependent rather than drug dependent, and they had longer stays in treatment (Table 1).

Significant age group differences in remission and abstinence were found across the 5-, 7-, and 9-year follow-up points among both women and men. At most follow-ups, older and middle-aged adults were more likely than younger adults to be remitted, to be abstinent from alcohol, and to be abstinent from drugs (Table 2).

There were significant differences in changes in marital

TABLE 2. Remission, alcohol abstinence, and drug abstinence by gender and age group at 5-, 7- and 9-year follow-ups

Variable	Age group at baseline			χ^2
	Age 18–39 (<i>n</i> = 990) %	Age 40–54 (<i>n</i> = 559) %	Age ≥ 55 (<i>n</i> = 97) %	
Remission in previous year				
Men				
Year 5	43.0	54.4	52.2 ^{a,c}	11.2**
Year 7	41.3	58.9	53.5 ^{a,c}	23.9***
Year 9	41.4	59.2	60.0 ^{a,c}	24.9***
Women				
Year 5	53.1	65.4	78.6 ^{a,c}	12.6**
Year 7	53.1	64.2	72.0	8.0*
Year 9	50.7	66.7	83.3 ^{a,c}	18.4***
Alcohol abstinence in previous year				
Men				
Year 5	34.9	43.6	43.3 ^c	7.3*
Year 7	31.1	46.2	45.8 ^{a,c}	20.1***
Year 9	33.8	48.8	57.5 ^{a,c}	22.8***
Women				
Year 5	40.8	56.6	67.9 ^{a,c}	17.5***
Year 7	40.1	55.2	56.0 ^{a,c}	11.6**
Year 9	41.2	57.1	70.8 ^{a,c}	16.7***
Drug abstinence in previous year				
Men				
Year 5	75.8	87.8	97.0 ^{a,c}	31.4***
Year 7	74.1	86.3	93.2 ^{a,c}	24.3***
Year 9	71.4	82.9	95.7 ^{a,c}	23.2***
Women				
Year 5	74.0	88.5	100.0 ^c	23.3***
Year 7	73.5	82.4	96.0	10.3**
Year 9	68.6	87.7	100.0 ^c	29.7***

Notes: Remission = either abstinence or light drinking or cannabis use only, with no associated substance problems. ^aSignificant difference between participants ages ≥ 55 and ages 18–39 at baseline, $p < .01$; ^bsignificant difference between participants ages ≥ 55 and ages 40–54 at baseline, $p < .01$; ^csignificant difference between participants ages 40–54 and ages 18–39 at baseline, $p < .01$.

* $p < .05$; ** $p < .01$; *** $p < .001$.

status at 5, 7, and 9 years and in employment status at 5 and 9 years. Older adults were less likely to have changes in marital status by 5 years, whereas younger and middle-aged adults were more likely either to become married or to become separated, divorced, or widowed. Younger adults were more likely than those in other age groups to become employed at Years 5 and 9 (Table 3).

Older adults were less likely than younger adults to be readmitted to AOD treatment (Year 7). They were less likely to have anyone in their social network who encouraged alcohol or drug use (Years 5–9). However, there were significant

TABLE 3. Life transition at 5-, 7-, and 9-year follow-ups, by age group

Variable	Age group at baseline			χ^2
	Age 18–39 (<i>n</i> = 990) %	Age 40–54 (<i>n</i> = 559) %	Age ≥ 55 (<i>n</i> = 97) %	
Marital status at:				
Year 5				28.7***
Remained the same	72.7	76.5	92.2 ^{a,b,c}	
Became married	16.0	9.3	2.2	
Became sep./div./wid.	11.4	14.2	5.6	
Year 7				13.3**
Remained the same	81.6	88.0	87.8 ^c	
Became married	11.2	6.2	3.7	
Became sep./div./wid.	7.2	5.8	8.5	
Year 9				10.9*
Remained the same	86.5	90.1	92.9	
Became married	8.6	4.0	4.3	
Became sep./div./wid.	4.9	5.9	2.9	
Employment status at:				
Year 5				25.7***
Remained the same	71.8	77.3	77.8 ^{a,c}	
Became employed	16.0	8.3	3.3	
Became unemployed	12.2	14.4	18.9	
Year 7				5.7
Remained the same	81.3	82.0	91.5	
Became employed	7.3	6.2	3.7	
Became unemployed	11.5	11.8	4.9	
Year 9				13.2*
Remained the same	80.4	85.7	84.3 ^c	
Became employed	9.8	4.2	4.3	
Became unemployed	9.8	10.1	11.4	
Self-rated health status at:				
Year 5				4.5
Remained the same	82.8	80.3	80.0	
Improved	7.6	7.1	5.6	
Worsened	9.6	12.6	14.4	
Year 7				3.8
Remained the same	84.8	81.5	80.5	
Improved	7.1	8.1	11.0	
Worsened	8.1	10.4	8.5	
Year 9				3.0
Remained the same	84.7	81.4	87.1	
Improved	7.1	8.7	7.1	
Worsened	8.2	9.9	5.7	

Notes: Health status improved = change from fair or poor to excellent, very good, or good. Health status worsened = change from excellent, very good, or good to fair or poor. Sep./div./wid. = separated/divorced/widowed. ^aSignificant difference between participants ages ≥ 55 and ages 18–39 at baseline, $p < .01$; ^bsignificant difference between participants ages ≥ 55 and ages 40–54 at baseline, $p < .01$; ^csignificant difference between participants ages 40–54 and ages 18–39 at baseline, $p < .01$.

* $p < .05$; ** $p < .01$; *** $p < .001$.

TABLE 4. Treatment readmission, social support and 12-step attendance at 5-, 7-, and 9-year follow-ups, by age group

Variable	Age group at baseline			χ^2 or F
	Age 18–39 ($n = 990$)	Age 40–54 ($n = 559$)	Age ≥ 55 ($n = 97$)	
AOD readmission, %				
Year 5	15.7	19.0	14.4	3.2
Year 7	9.9	6.4	1.0 ^a	12.7**
Year 9	6.5	5.7	1.0	4.7
Have anyone who encourages substance use, % saying yes				
Year 5	17.3	10.8	6.5 ^{a,c}	16.3***
Year 7	17.2	9.5	3.6 ^{a,c}	23.0***
Year 9	14.8	11.8	1.4 ^a	11.2**
Have anyone who supports recovery, % saying yes				
Year 5	82.0	83.1	77.4	1.7
Year 7	80.9	80.9	69.1	6.6*
Year 9	79.0	74.4	68.6	6.3*
No. of 12-step meetings attended in past year, M (SD)				
Year 5	33.1 (2.3)	33.8 (3.1)	28.6 (7.2)	0.22
Year 7	29.1 (2.3)	29.3 (3.0)	26.9 (7.2)	0.05
Year 9	30.1 (2.3)	26.6 (3.2)	24.8 (7.9)	0.52

Notes: AOD = alcohol and other drug. ^aSignificant difference between participants ages ≥ 55 and ages 18–39 at baseline, $p < .01$; ^bsignificant difference between participants ages ≥ 55 and ages 40–54 at baseline, $p < .01$; ^csignificant difference between participants ages 40–54 and ages 18–39 at baseline, $p < .01$.

* $p < .05$; ** $p < .01$; *** $p < .001$.

overall age differences in whether or not patients had anyone actively supporting their efforts to reduce use (Years 7 and 9), with trends indicating that older adults may be less likely to have such support (Table 4).

Mixed-effects logistic models examined factors associated with past-year alcohol abstinence, drug abstinence, and remission across Years 5–9. We found that a longer stay in index treatment and having any close friends supporting efforts to reduce AOD use during follow-ups were positively associated with all three outcomes. Being age 18–39 at treatment entry; losing a partner to separation, divorce, or death; being readmitted to treatment; and having any close friends encouraging AOD use during follow-ups were negatively associated with all three outcomes. Male gender and decline in health status during follow-ups were negatively associated with past-year alcohol abstinence and remission over time. Compared with those who had no change in employment status, those becoming employed had higher odds of being abstinent from alcohol, whereas those becoming unemployed had lower odds of being abstinent from drugs. Older adults had the highest odds of being abstinent from drugs during follow-ups (Table 5).

Interaction between age and gender was not significant in any of the models on AOD outcomes. We found significant interactions between age group and readmission to AOD treatment ($p = .046$), changes in health status ($p = .004$), and changes in social support ($p = .06$) on remission. When

examining these interactions, we did not find significant differences between those ages 40–54 and 55 and older, and thus we combined these groups. Those age 40 and older with readmissions to AOD treatment had the lowest odds of being remitted over time. In addition, the negative associations between having close friends encourage AOD use during follow-ups and remission were stronger among those ages 18–39. Compared with those age 40 and older whose health worsened or remained the same, those age 40 and older with improved health were more than twice as likely to be remitted across Years 5–9, whereas the odds of being remitted did not differ significantly by health status improvement for those ages 18–39. A similar interaction was found between age group and change in health status on drug abstinence over time (not shown).

Discussion

Long-term alcohol and other drug outcomes

This study examined the effects of age and life transitions on remission and abstinence 5–9 years after outpatient treatment in a model that included index treatment length, readmission, and social support. It was based on developmental and stress-and-coping theories regarding the effect of aging and significant events on recovery across the life course. Our findings indicate that middle-aged and older adults have better remission and abstinence outcomes compared with younger adults and that life transitions vary by age group. These findings build on the results of studies that found that older adults have short-term outcomes as good as or better than those of younger adults (Oslin et al., 2002; Satre et al., 2003) and that older women have better outcomes than other age–gender subgroups (Satre, et al., 2004). The results also provide evidence that these patterns persist over time. Our results highlight the relatively favorable long-term prognosis of older adults and women in AOD treatment and the ongoing effect of index treatment length.

Readmission was associated with worse outcomes at 5–9 years, especially among those age 40 and older at baseline (based on interaction results). Among patients who have not been abstinent over the short term, readmission is associated with abstinence over longer follow-up periods (Weisner et al., 2003) and, therefore, is desirable. However, studies have also shown that patients readmitted to treatment have had shorter initial treatment stays and greater problem severity (Callaghan, 2003; Moos et al., 1994), although readmission may be independent of patient outcome measures. Thus, readmission may represent relapse or more severe AOD problems among the patients in the sample, particularly among those age 40 and older at baseline.

Similarly, greater initial length of stay in treatment, which predicted good outcomes many years later, is subject to self-selection bias and may serve as a proxy for other factors

TABLE 5. Mixed-effects logistic regression models predicting past-year AOD treatment outcomes at 5-, 7-, and 9-year follow-ups

Variable	Past-year alcohol abstinence			Past-year drug abstinence			Past-year remission		
	OR	[95% CI]	<i>p</i>	OR	[95% CI]	<i>p</i>	OR	[95% CI]	<i>p</i>
Baseline predictors									
Age < 40 (vs. age 40–54)	0.51	[0.33, 0.79]	.0029	0.48	[0.32, 0.72]	.0004	0.47	[0.33, 0.69]	.0001
Age ≥ 55 (vs. age 40–54)	1.24	[0.53, 2.92]	.6172	4.58	[1.52, 13.84]	.0070	1.04	[0.50, 2.17]	.9176
Women (vs. men)	2.11	[1.42, 3.14]	.0002	0.99	[0.70, 1.42]	.9679	2.17	[1.55, 3.05]	<.0001
White (vs. non-White)	1.06	[0.68, 1.65]	.8055	0.82	[0.55, 1.21]	.3135	0.91	[0.63, 1.33]	.6371
≥Some college (vs. less)	1.33	[0.89, 1.98]	.1692	0.80	[0.55, 1.15]	.2246	1.08	[0.77, 1.52]	.6416
Dependent on drugs only/both at baseline (vs. alcohol only/neither)	0.52	[0.34, 0.79]	.0022	0.22	[0.15, 0.32]	<.0001	0.74	[0.52, 1.04]	.0859
Baseline AOD treatment modality	1.32	[0.89, 1.96]	.1717	0.73	[0.51, 1.04]	.0792	1.11	[0.80, 1.55]	.5339
Baseline AOD treatment length (per 1-week increase)	1.06	[1.04, 1.07]	<.0001	1.03	[1.02, 1.05]	<.0001	1.05	[1.04, 1.06]	<.0001
Time-varying predictors									
AOD treatment readmission at follow-ups (vs. not)	0.53	[0.36, 0.79]	.0019	0.52	[0.35, 0.77]	.0010	0.46	[0.32, 0.66]	<.0001
Employment status change from prior interview wave:									
Becoming employed (vs. no change)	1.52	[1.00, 2.32]	.0512	1.15	[0.75, 1.74]	.5222	1.36	[0.93, 1.99]	.1165
Becoming unemployed (vs. no change)	1.03	[0.70, 1.50]	.8922	0.55	[0.39, 0.80]	.0016	0.96	[0.68, 1.34]	.7960
Marital status change from prior interview wave:									
Becoming married/living as married (vs. no change)	0.73	[0.49, 1.09]	.1227	0.89	[0.60, 1.32]	.5677	0.67	[0.47, 0.96]	.0303
Becoming separated/divorced/widowed (vs. no change)	0.52	[0.33, 0.82]	.0052	0.63	[0.41, 0.97]	.0359	0.48	[0.32, 0.72]	.0004
Health status change from prior interview wave:									
Improved (vs. no change)	1.20	[0.77, 1.87]	.4177	1.22	[0.76, 1.95]	.4192	1.14	[0.75, 1.71]	.5450
Worsened (vs. no change)	0.66	[0.43, 1.00]	.0506	0.73	[0.49, 1.10]	.1315	0.64	[0.44, 0.93]	.0206
Have anyone who encourages substance use (vs. none)	0.28	[0.18, 0.42]	<.0001	0.23	[0.16, 0.33]	<.0001	0.23	[0.16, 0.32]	<.0001
Have anyone who supports recovery (vs. none)	3.40	[2.39, 4.86]	<.0001	1.46	[1.06, 2.02]	.0212	2.33	[1.73, 3.14]	<.0001

Notes: **Bold** indicates statistical significance. AOD = alcohol and other drugs. Baseline AOD treatment modality = day hospital vs. regular outpatient care.

associated with AOD recovery, including individual characteristics. For example, length of stay has been associated with having an abstinence goal, having lower psychiatric severity, and having an employer suggest treatment (Greenfield et al., 2007; Mertens and Weisner, 2000). Therefore, that length of stay predicts abstinence and remission is not by itself evidence of the impact of staying longer in treatment.

Life transitions

We found that the occurrence of clinically relevant life transitions varied by age group over time. Based on developmental models, it has been hypothesized that indicators of improved social adjustment, including becoming married or partnered, may point to recovery (Curran et al., 1998). Loss of a partner signals a stressful event as well as a decrease in resources and support that may have a negative impact based on general population studies of divorce (Power et al., 1999; Prescott and Kendler, 2001) and widowhood (Eng et al., 2005). We found that both losing a partner and becoming

married were associated with lower rates of remission; and that prevalence of these very important life transitions was significantly different across age groups. From a recovery management perspective, our results in this sample highlight the need to plan for the potential negative impact of relationship transitions. For example, the educational components of outpatient treatment and aftercare could prepare patients for the possible effect on substance use of either entering into a new relationship or losing a partner, and attempt to mitigate this impact through increased self-help group attendance (e.g., 12-step group participation or other active coping strategies to enhance recovery support).

Similarly, long-term community studies have found that becoming employed reduced problematic drinking and intoxication (Gotham et al., 1997). Involuntary loss of employment has been associated with drug use in AOD treatment samples (Wiesner et al., 2010), and with mental health problems in the general population (Kuhn et al., 2009). Although we did not differentiate retirement from other types of job loss, because very few older adults

reported drug use, it is not likely that retirement is a significant component of our finding regarding employment status and drug use. Our results support the importance of employment in maintaining long-term recovery, which some treatment programs aim to enhance through integrating vocational services.

Having worsened self-reported health as a time-varying covariate was associated with lower odds of alcohol abstinence and remission. Improvement in health status was associated with better outcomes, especially among adults ages 40 and older, based on analysis of age group interactions. Other Age $\times$ Life Event interactions were not significant, suggesting that important events, such as becoming employed or losing a partner, exert influence on recovery regardless of patient age.

Social support

Having any individuals supportive of recovery and having no individuals influencing patients to use alcohol or other drugs were both helpful in maintaining recovery over time, and this had important age group differences. Younger and middle-aged adults were more likely than older adults to have a close friend who encourages AOD use, and interaction results showed that the impact on remission was greater among those younger than 40. Both 12-step and behavioral relapse prevention models emphasize developing social relationships supportive of recovery and minimizing the influence of individuals who use substances. For younger and middle-aged adults who continue to have close friends who encourage AOD use many years after participating in AOD treatment, considering how to mitigate these social influences may be especially important in planning for long-term recovery.

Limitations and strengths of the study

On some measures, differences between older and middle-aged adults were not significant, despite apparent linear trends in the data (e.g., remission and abstinence rates between middle-aged and older women). Significance testing may have been limited by the small sample size of the older group relative to the other age groups. Therefore, our results may underestimate some differences, especially between older and middle-aged adults. Because of sample size limitations, we did not differentiate separation, divorce, and widowhood, nor could we separately examine the effects of retirement versus loss of job for other reasons, which we would expect to vary by age group. The relationships between these changes and AOD use are likely to be complex and multidirectional, and the positive or negative effect of a given life event may vary depending on patient age and individual circumstances (Perreira and Sloan, 2001). The time windows for measuring life

transitions were 4 years prior at 5-year follow-ups and 2 years prior at 7-year and 9-year follow-ups. AOD, however, was measured for 1 year prior at the follow-up interviews. Thus, the temporality is not ideal with the 1-year overlap, and current analyses cannot rule out the likely reciprocal effects between life transitions and AOD use. In addition, causal inference cannot be drawn from our data because of the observational study design, although we note that it is impracticable to conduct a randomized control trial to examine the current research questions. Given the data available, our models controlled for a thorough list of potential confounding factors. Future studies with larger sample size and lagged measures over time are needed to more fully understand the relationships between life transitions and long-term recovery from AOD problems across life stages, including the impact of widowhood and retirement on recovery in older adult treatment samples.

The sample had a limited number of non-White participants, especially among older adults, which may limit the generalizability of the study findings. In addition, the study was conducted in a privately insured population, which may have lower levels of AOD problem severity than public samples, and the effects of some life stressors and transitions (such as loss of employment) potentially could be different in a public sample. Despite the limitations, this long-term study in a large outpatient program addresses important issues in the field regarding the role of age and life transitions on AOD outcomes. The study examined understudied populations—including privately insured individuals, older adults, and women—in a large treatment sample with a high long-term follow-up rate. Building on prior life span-oriented studies of general populations, we used longitudinal methodology to examine age group differences in changes in employment, marital and health status across time, and the impact of these factors on outcomes from 5 to 9 years post-treatment.

Conclusions

This study examined domains hypothesized to influence long-term AOD recovery, building on life span models of AOD use previously examined primarily in general population samples. In a treatment context with a more severe and heterogeneous population, some similarities hold: Negative life transitions in relationships, employment, and health varied by age and were associated with worse outcomes. Yet, most life transitions that we examined (e.g., getting married or losing a partner, becoming unemployed) are so significant as to be important predictors of outcomes regardless of age.

Acknowledgments

The authors thank Agatha Hinman, B.A., for editorial assistance.

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