Driving While Intoxicated Among Individuals Initially Untreated for Alcohol Use Disorders: One- and Sixteen-Year Follow-Ups*

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ABSTRACT. Objective: This study examined associations between frequency of driving while intoxicated (DWI) at baseline and obtaining alcohol-related help at follow-up, and between obtaining help and subsequent reductions in DWI. It also examined improvements on personal functioning and life context indices as mediators between obtaining help and reduced occurrences of DWI. **Method:** A total of 628 individuals who were initially untreated for alcohol use problems completed a baseline inventory; follow-ups were 1, 3, and 16 years later. **Results:** More extended participation in outpatient treatment and Alcoholics Anonymous (AA) during Year 1 was associated with a lower likelihood of DWI at the 1-year follow-up. More extended participation in AA through Year 3 was associated with a lower likelihood of DWI at the 16-

year follow-up. Improvement on personal functioning and life context indices was associated with reduced risk of subsequent occurrences of DWI. Decreases in drinking-related problems, impulsivity, and drinking to reduce tension mediated associations between more AA participation and reductions in DWI at 1 year. **Conclusions:** Among initially untreated individuals, sustained mutual help may be associated with a reduced number of occurrences of DWI via fewer drinking consequences and improved psychological functioning and coping. Treatment providers should attend to these concomitants of DWI and consider actively referring individuals to AA to ensure ongoing AA affiliation. (*J. Stud. Alcohol Drugs*, 72, 173-184, 2011)

DRIVING WHILE INTOXICATED (DWI) is a major public health problem in the United States. Each year, there are an estimated 160 million incidents of DWI, resulting in more than 17,000 deaths. An estimated 3 of every 10 Americans will be involved in an alcohol-related crash in their lifetime (National Highway Traffic Safety Administration, 2004; Quinlan et al., 2005).

The majority of studies of DWI have focused on community samples or samples of people arrested and convicted for DWI who were mandated to treatment. In contrast, we examined DWI in a sample of individuals who, at entry into the study, had initiated help seeking but were untreated for alcohol use problems; these individuals were followed for 16 years. Compared with non-help-seeking community samples, these help seekers likely have more severe alcohol-related dysfunction (George and Tucker, 1996; Tucker, 1995) but also more recognition of their alcohol misuse, motivation to

change, and commitment to abstinence (Timko et al., 1994). However, compared with individuals reporting previous treatment for alcohol use disorders, these individuals likely have less severe alcohol-related dysfunction but also less motivation to change and commitment to abstinence (LoCastro et al., 2008). Thus, in the context of previous studies of DWI, we examined a sample that, by virtue of seeking help for the first time, was unique in terms of severity of alcohol-related disorder and motivation to change.

To examine the behavior of DWI, this study used the conceptual framework developed by Moos and colleagues (Moos and Finney, 1983; Moos et al., 1990b) and adopted by other investigators (e.g., Buri et al., 2007) to examine the context of alcohol-related outcomes (Figure 1). The framework suggests that there is an association between (a) the individual's functioning and life context (e.g., severity of alcohol misuse, psychological symptoms, negative life events, social support) and (b) the frequency of DWI at baseline. Together, functioning and life context combined with DWI frequency influence the type (e.g., professional outpatient treatment, mutual help) and amount of help received. In turn, help utilization influences the individual's functioning and life context at follow-up, as well as the extent of subsequent DWI.

Following the model, we examined associations between DWI frequency (Domain II) and obtaining alcohol-related help (Domain III). We also examined obtaining alcohol-related help (Domain III) as a predictor of a reduction in the

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FIGURE 1. Model of changes in driving while intoxicated (DWI) frequency over time

likelihood of subsequent DWI (Domain V) and changes in functioning and life context (Domain IV) as potential mediators between obtaining help (Domain III) and a reduction in subsequent DWI (Domain V).

Treatment, mutual help, and DWI

Few studies have examined associations of DWI with subsequent participation in treatment and Alcoholics Anonymous (AA), that is, the link between Domains II and III in our model. More frequent occurrences of DWI may be associated with more use of help because it is associated with greater alcohol use severity (Duncan et al., 1999; Gruenewald et al., 1996) and with potential serious harm to self and others (Biffel et al., 2004; Kenkel, 1993; Voas and Fisher, 2001). Such harm includes the time and financial costs of conducting a legal defense if arrested; difficulties obtaining and paying for automobile insurance; and mandated fines, driver's license sanctions, and vehicle incapacitation or impoundment. More serious harm includes incarceration, supervised probation and monitoring, or consequent long-term unemployment, as well as injury, disability, or death. Hoffmann et al. (1987) found mixed support for the DWI-help link among outpatients: Those arrested for DWI were more likely than those not arrested (who may or may

not have engaged in DWI) to complete treatment, but rates of AA attendance were similar for the two groups.

Similarly, few studies have examined associations of treatment and AA with the outcome of subsequent DWI, that is, the link between Domains III and V. In a study of mandated treatment for substance misuse, clients referred to treatment because of DWI who participated in 12-step groups had more positive treatment outcomes (e.g., were less likely to be using alcohol) at a 1-year follow-up than those who did not participate (Walker et al., 2008). First-time and repeat DWI offenders who were assigned by a state program to treatment or AA did not differ on DWI recidivism rates over the subsequent 8 years (Green et al., 1991).

Mechanisms to explain reductions in DWI

Even fewer studies have examined mechanisms that may explain why some individuals engage less frequently over time in DWI. However, studies that examined how characteristics of individuals (Domain I) are related to DWI (Domain II) suggest that improvements in functioning and life context may help explain subsequent reductions in DWI. Regarding functioning, more frequent and heavier drinking (Duncan et al., 1999; Gruenewald et al., 1996), higher levels of impulsivity and depression, less self-esteem (Donovan and Marlatt,

1982; Holt et al., 2009; Lapham et al., 2001; Reynolds et al., 1991; Veneziano and Veneziano, 1992), and less social support (Kennedy et al., 1997; Nelson et al., 1999) were related to a higher likelihood of and more frequent occurrences of DWI. People who experienced a poor life context (high rates of negative life events) and coped poorly also were more likely to have driving problems or drive while they were intoxicated (Su et al., 2009; Veneziano and Veneziano, 1992; Woldt and Bradley, 2002). Functioning may be poorer among repeat DWI offenders than among first- or one-time offenders. More severe alcohol disorders, low self-efficacy, and more severe psychiatric profiles were associated with a higher likelihood of DWI recidivism (DeYoung, 1997; Freeman et al., 2005; Greenberg et al., 2004, 2005; Lapham et al., 2001, 2006; LaPlante et al., 2008; Shaffer et al., 2007).

In the only study we identified that directly addressed the issue of mechanisms explaining why some individuals engage less in DWI over time, Johnson and White (1989) found that less reliance on alcohol to cope with stressors explained why some young adults had fewer occurrences of DWI. In particular, research has not examined the associations between obtaining help—either treatment or mutual help (Domain III)—and changes in individuals' functioning and life context (Domain IV) that may be associated with less frequent DWI (Domain V). However, previous studies of this sample found that treatment and/or 12-step group participation was associated with positive changes in short- and long-term functioning and life context indices (e.g., Moos and Moos, 2006a, 2006b). Such positive changes might help explain why utilizing help for alcohol use disorders is associated with reductions in DWI frequency.

In this study, we compared three groups of individuals who had an alcohol use problem, were initiating help seeking, and had never received treatment at baseline: those who, at baseline, reported no DWI; those who reported DWI "once or twice"; and those who reported DWI more often. We focused on three questions: (1) Do the three groups differ in the extent to which they obtain help from professional treatment or AA during Year 1 and Years 2-3 of follow-up (i.e., is there an association between indices in Domains II and III)? (2) Does obtaining help lessen the likelihood of subsequent occurrences of DWI at 1- and 16-year follow-ups (i.e., is there an association between Domains III and V)? (3) Do improvements in functioning and life context (Domain IV) (a) lessen the likelihood of subsequent DWI (Domain V) and (b) mediate between participation in treatment or AA and a lower likelihood of subsequent DWI?

Method

Sample and procedure

The participants were individuals with alcohol use problems who, at baseline, had not received treatment for their

disorder. These individuals had an initial contact with the alcoholism treatment system via information and referral centers or detoxification programs (Finney and Moos, 1995). After providing informed consent, 628 eligible individuals completed a baseline inventory.

At 1, 3, 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. Response rates at the 1-, 3-, and 16-year follow-ups were 82% ($n = 515$), 77% ($n = 468$), and 80% ($n = 405$), respectively, among participants not known to have died. The only significant differences between individuals who were or were not followed were that followed participants were more likely to be women and to be employed at baseline ($p < .05$). Individuals who infrequently or often engaged in DWI, or who did not engage in DWI, at baseline had comparable response rates at follow-ups.

The 628 individuals were almost evenly divided between women (47.1%) and men (52.9%). Most were White (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 ($M = 34.7$ years, $SD = 9.4$), had 13 years of education ($M = 13.1$ years, $SD = 2.3$), and had an annual income of U.S. \$12,225.

Individuals who entered the study confirmed the lack of previous treatment and had an alcohol use problem as determined by one or more substance use problems, dependence symptoms, drinking to intoxication during the past month, and/or perception of alcohol use as a significant problem. In fact, 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 last month, and had an average of 3.9 ($SD = 6.8$) dependence symptoms (e.g., 70.6% had blackouts, 70.2% had fevers, and 64.9% had "shakes") and 3.8 drinking problems ($SD = 6.1$). Participants first recognized their drinking as a problem an average of 6.8 years earlier ($SD = 6.8$).

Measures

DWI. At baseline and at 1- and 16-year follow-ups, participants were asked, "In the last six months, how often have you had the following problem as a result of your drinking: Driving while intoxicated?" Responses were coded on a 5-point scale (0 = *never*; to 4 = *often*).

Personal and help characteristics. In addition to obtaining respondents' demographic information at baseline, we assessed, at baseline and the 1- and 3-year follow-ups, (1) functioning and life context indices (drinking patterns, psychosocial functioning, negative events and coping) and (2) help obtained.

Drinking patterns. Drinking-related problems, an index on the Health and Daily Living Form (HDL; Moos et al., 1990a), 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 eight problems as a result of drinking (e.g., job, money) (Cronbach's α at baseline = .80). Alcohol-dependence symptoms, which were 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., had blackouts, had cravings for a drink first thing when waking up) (α at baseline = .88). Self-efficacy to resist alcohol was assessed with 14 items (α at baseline = .93) selected from the Situational Confidence Questionnaire (Annis and Graham, 1988). Each item was rated on a 6-point scale from 0 = *not at all confident*, to 5 = *very confident*, and responses were summed. Respondents noted the number of days they were drunk or intoxicated during the past month.

Psychosocial functioning. Impulsivity was the sum of ten 4-point items (e.g., "I usually act on the first thought that comes into my head"; 0 = *strongly disagree*, 3 = *strongly agree*; α at baseline = .74) selected from the Personality Response Form (Jackson and Messick, 1986). Depression was measured as in the HDL; respondents rated how often (on a 5-point scale; 0 = *never*, 4 = *often*) they experienced each of nine symptoms of depression in the past month, for example, feeling sad or blue (α at baseline = .92). Participants completed Rosenberg's (1989) Self-Esteem Scale, which consisted of 10 items (e.g., "I feel that I have a number of good qualities") rated on a 4-point scale (0 = *strongly disagree*, 3 = *strongly agree*; α at baseline = .85).

On the HDL, frequency of social support in the past month was the sum of three items measuring the number of times participating in organizations, visiting with friends, and visiting with relatives. Quality of friendship support, which was also measured on the HDL, was the sum of six items (e.g., "you get along well with your friends"; 0 = *never*, 4 = *often*; α = .88), and friendship strain was the sum of four items rated on the same scale (e.g., "your friends disagree with you about important things"; α = .73).

Negative events and coping. The HDL was used to obtain a measure of the number, out of 38, of negative life events that occurred for the respondent in the past year. Problem-solving coping responses were measured by five items taken from the Coping Responses Inventory (Moos, 1993; e.g., "I made a plan of action and followed it"; α = .75). Items were rated on a 4-point scale (0 = *did not do this*, 3 = *did this fairly often*) and summed. A single 4-point item asked respondents whether, in trying to manage a significant problem, they tried to reduce tension by drinking more (0 = *no*, 3 = *often*).

Help obtained. At the 1- and 3-year follow-ups, participants were asked, "Have you gone to anyone, anyone at all, about your drinking habits or drinking-related problems?" since they completed the previous questionnaire. The month and year 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. There is support for the reliability and validity of self-reports regarding participation in substance use-related treatment (Adair et al., 1996) and AA (Morgens-tern et al., 1997; Tonigan et al., 2002; Walitzer et al., 2009). Responses were used to construct indices pertaining to outpatient treatment (any attendance or not, duration in weeks) and AA (any attendance or not, duration) between baseline and 1 year as well as between 1 and 3 years.

Analyses

First, we used analysis of covariance to compare the three groups (no DWI, DWI once or twice, DWI often) on help obtained at follow-ups (Domain III), controlling for demographic differences. Next, we conducted logistic regression analyses (because the dependent variables had a nonnormal distribution and were dichotomized) predicting DWI at 1 year and 16 years (Domain V) from help received (Domain III). Block 1 entered baseline demographics and baseline DWI (dummy coded), and, in Block 2, we conducted separate regressions entering one treatment or AA-related variable at a time. Similarly, we conducted logistic regressions, controlling for baseline demographics and baseline DWI, predicting DWI at 1 and 16 years (Domain V) from changes in drinking and psychosocial indices (Domain IV), again in separate regressions entering one predictor at a time.

Finally, we conducted regression analyses to explore potential mediators (i.e., changes in drinking and psychosocial indices; Domain IV) of the help-DWI (Domain III-Domain V) associations we found (Baron and Kenny, 1986; Kenny, 2008); *these regressions also controlled for baseline demographics and baseline DWI*. For each help-potential mediator pair, we conducted three sets of regressions: (1) the help index to predict the potential mediator, (2) the potential mediator to predict DWI, and (3) both the help index and the potential mediator to predict DWI. To establish mediation, the help index had to significantly predict the potential mediator, and the potential mediator had to predict DWI. If, in Set 3, the help index at baseline no longer predicted DWI as strongly and the Sobel test (MacKinnon et al., 1995) was significantly different from zero, then the potential mediator partially mediated between help and DWI.

Results

At baseline, 22% ($n = 137$) of participants reported infrequent occurrences of DWI (i.e., once or twice) in the past 6 months, and 38% ($n = 239$) engaged in DWI often during that period. Forty percent ($n = 252$) of participants had no occurrences of DWI during the past 6 months.

TABLE 1. Help obtained by participants who reported never, infrequently, or often driving while intoxicated (DWI) at baseline

Variable	DWI never <i>M (SD)</i>	DWI infrequently <i>M (SD)</i>	DWI often <i>M (SD)</i>	<i>F</i>
Help during Year 1				
Any outpatient treatment	36.9% (48.3)	45.5% (50.0)	34.5% (47.7)	1.92
Weeks of outpatient treatment	8.8 (19.5)	10.7 (17.6)	8.0 (17.2)	0.81
Any AA	47.8% ^{a,b} (50.0)	65.2% ^a (47.9)	61.5% ^b (48.8)	5.97**
Weeks of AA	12.5 ^{a,b} (18.0)	18.2 ^a (20.3)	16.8 ^b (19.5)	4.09*
Help during Years 2-3				
Any outpatient treatment	19.1% (39.3)	19.0% (39.4)	18.4% (38.8)	0.02
Weeks of outpatient treatment	8.8 (31.5)	14.5 (41.5)	9.3 (29.4)	1.42
Any AA	28.6% (45.3)	39.6% (49.1)	34.4% (47.7)	1.93
Weeks of AA	20.2 (44.0)	26.7 (48.0)	26.1 (48.6)	0.97

Notes: Statistics in a given row with the same superscript letter are significantly different from one another. At Year 1 follow-up, *ns* were 203, 112, and 200 for DWI never, DWI infrequent, and DWI often, respectively. At Year 3 follow-up, *ns* were 182, 106, and 180 for DWI never, DWI infrequent, and DWI often, respectively. AA = Alcoholics Anonymous.

p* < .05; *p* < .01.

Treatment, AA, and DWI

Preliminary analyses showed that individuals who never engaged in DWI were older than those who did, and those who drove while intoxicated infrequently had a higher family income than individuals who never or often drove while intoxicated. Accordingly, we controlled for age and family income in all subsequent analyses. As shown in Table 1, compared with those who reported no DWI, individuals who reported DWI at baseline, either infrequently or often, were more likely to attend AA but were not more likely to

obtain treatment, during the first follow-up year. On average, the infrequent and often DWI groups attended AA over a longer duration in the first year than did the group that did not engage in DWI. The three groups did not differ on help received during Years 2-3.

Associations of treatment and AA with DWI at 1 and 16 years

Table 2 presents logistic regressions predicting DWI at 1 and 16 years (Domain V) from help obtained during Year 1

TABLE 2. Logistic regressions with treatment and AA during Year 1 and Years 2-3 as predictors of DWI (0 = no, 1 = yes) at 1 and 16 years

Variable	DWI at 1 year			DWI at 16 years		
	<i>B</i>	AOR	95% CI	<i>B</i>	AOR	95% CI
Block 1						
Baseline age	-0.025*	0.97	0.95, 0.99	-0.054*	0.94	0.91, 0.99
Baseline family income	0.005	1.01	0.99, 1.01	0.006	1.00	0.99, 1.02
Baseline DWI never	(referent)			(referent)		
Baseline DWI infrequent	0.461	1.59	0.84, 2.98	0.041	1.04	0.41, 2.21
Baseline DWI often	1.255***	3.51	2.08, 5.91	0.334	1.40	0.65, 3.01
Baseline DWI infrequent (referent) vs. often	0.794**	2.21	1.27, 3.84	0.292	1.34	0.68, 2.64
Block 2: Baseline to 1 year						
Any outpatient treatment	-0.386	0.68	0.43, 1.08	-0.447	0.63	0.32, 1.26
No. of weeks of outpatient	-0.020*	0.98	0.97, 0.99	-0.020	0.98	0.96, 1.00
Any AA	-0.736***	0.47	0.31, 0.74	-0.441	0.64	0.33, 1.25
No. of weeks of AA	-0.027***	0.97	0.96, 0.98	-0.021*	0.97	0.96, 0.99
Block 2: 2-3 years						
Any outpatient treatment				-0.628	0.53	0.23, 1.23
No. of weeks of outpatient				-0.032	0.96	0.94, 1.00
Any AA				-0.067	0.53	0.26, 1.12
No. of weeks of AA				-0.014*	0.98	0.97, 0.99

Notes: Variables in Blocks 2 were entered one at a time in separate regressions. AA = Alcoholics Anonymous; DWI = driving while intoxicated; AOR = adjusted odds ratio; CI = confidence interval.

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

or during Years 2-3 (Domain III), controlling for age, family income, and baseline DWI. Individuals who engaged in DWI often at baseline were more than three times as likely to have a DWI at 1 year compared with those who had no DWI at baseline and were more than two times as likely to have a DWI at 1 year compared with those who had engaged in DWI infrequently at baseline.

A longer duration of outpatient treatment during Year 1 was associated with a lower likelihood of DWI at the 1-year follow-up, as were attending AA and a longer duration of AA attendance. Furthermore, a longer duration of AA attendance—either between baseline and 1 year or during Years 2-3—was associated with a lower likelihood of DWI at 16 years.

Associations of drinking and psychosocial indices with DWI at 1 and 16 years

We examined changes between baseline and 1 year, as well as between 1 year and 3 years, on functioning and life context indices (changes from Domain I to Domain IV) as predictors of DWI at 1 and 16 years (Domain V), controlling for age, family income, and baseline DWI. Specifically, for

negative outcomes, higher scores indicated a greater decline (change score = baseline – 1 year). For positive outcomes (drinking self-efficacy, self-esteem, frequency of support, quality of friendship support, and problem-solving coping), higher scores indicated a greater increase (change score = 1 year – baseline).

Table 3 shows that when entered singly, decreases in drinking-related problems, alcohol-dependence symptoms, and days drunk or intoxicated, as well as increases in drinking self-efficacy, between baseline and 1 year were associated with a lower likelihood of DWI at the 1-year follow-up, as were decreases in impulsivity and depression and increases in self-esteem. Increases in social functioning (frequency, quality), decreases in negative life events and drinking to reduce tension, and increases in problem-solving coping between baseline and 1 year also were associated with less risk of DWI at the 1-year follow-up.

Several changes between baseline and 1 year predicted less DWI at 16 years (Table 3): increases in drinking self-efficacy; decreases in days drunk or intoxicated, depression symptoms, and negative life events; and increases in problem-solving coping. Only one change between 1 and 3 years predicted DWI at 16 years (not shown in Table 3):

TABLE 3. Logistic regressions with change on drinking and psychosocial indices as predictors of DWI (0 = no, 1 = yes) at 1 and 16 years

Variable	DWI at 1 year			DWI at 16 years		
	<i>B</i>	AOR	95% CI	<i>B</i>	AOR	95% CI
Block 1						
Baseline age	-0.025*	0.97	0.95, 0.99	-0.054*	0.94	0.91, 0.99
Baseline family income	0.005	1.01	0.99, 1.01	0.006	1.00	0.99, 1.02
Baseline DWI never	(referent)			(referent)		
Baseline DWI infrequent	0.461	1.59	0.84, 2.98	0.041	1.04	0.41, 2.21
Baseline DWI often	1.255***	3.51	2.08, 5.91	0.334	1.40	0.65, 3.01
Baseline DWI infrequent (referent) vs. often	0.794**	2.21	1.27, 3.84	0.292	1.34	0.68, 2.64
Block 2						
Change from baseline to 1 year						
Drinking-related problems	-0.145***	0.86	0.83, 0.90	-0.029	0.97	0.93, 1.02
Alcohol dependence	-0.130***	0.87	0.85, 0.91	-0.024	0.97	0.94, 1.01
Drinking self-efficacy	-0.023***	0.97	0.97, 0.98	-0.014*	0.98	0.98, 0.99
Days drunk or intoxicated	-0.038***	0.96	0.94, 0.98	-0.046**	0.95	0.93, 0.98
Impulsivity	-0.840**	0.91	0.87, 0.97	0.006	1.00	0.94, 1.07
Depression	-0.070***	0.93	0.91, 0.95	-0.043*	0.95	0.93, 0.99
Self-esteem	-0.127***	0.88	0.84, 0.92	-0.055	0.94	0.89, 1.00
Frequency of social support	-0.013*	0.98	0.98, 0.99	-0.005	0.99	0.98, 1.01
Quality of friendship support	-0.078***	0.92	0.88, 0.96	-0.037	0.96	0.90, 1.03
Friendship strain	-0.045	0.95	0.88, 1.03	0.045	1.05	0.92, 1.18
Negative events	-0.090**	0.91	0.85, 0.98	-0.109*	0.89	0.81, 0.99
Problem-solving coping	-0.122***	0.88	0.84, 0.94	-0.088*	0.91	0.85, 0.99
Drank more to reduce tension	-0.705***	0.49	0.41, 0.59	-0.164	0.84	0.68, 1.05

Notes: Variables in Block 2 were entered one at a time in separate regressions. DWI = driving while intoxicated; AOR = adjusted odds ratio; CI = confidence interval.

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

FIGURE 2. Mediator of any Alcoholics Anonymous (AA) attendance (between baseline and 1 year) and driving while intoxicated (DWI) at 1 year (controlling for age, family income, and baseline DWI). Values shown are unstandardized regression coefficients.

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

Increases in social support frequency were associated with a lower likelihood of DWI ($B = -0.023$, $p < .05$, adjusted odds ratio [AOR] = 0.97, 95% CI [0.96, 0.99]).

Mediators between help and reductions in DWI at 1 year

As shown in Table 2, attending outpatient treatment for a longer duration and participation in AA in Year 1 (attending AA and attending for a longer duration) were associated with a lower likelihood of DWI at 1 year. We examined potential mediators of these associations, controlling for age, family income, and baseline DWI; the potential mediators were changes between baseline and 1 year on the functioning and life context indices. None of the change scores significantly mediated between the duration of outpatient treatment and DWI at 1 year.

However, greater decreases in impulsivity partially mediated the association between attending AA during Year 1 and reduced DWI at 1 year. As shown in Figure 2, participating in AA during Year 1 predicted greater decreases in impulsivity at 1 year, which predicted a lower likelihood of DWI at 1 year (AOR = 0.92, 95% CI [0.88, 0.97]). When any participation in AA and decreases in impulsivity were entered together to predict DWI, the association of any AA with DWI was weaker but still significant (AOR = 0.49, 95% CI [0.18, 0.50]). Decreases in impulsivity still significantly predicted a lower likelihood of DWI (AOR = .93, 95% CI [0.88, 0.98]). The indirect effect of any AA on DWI at 1 year via reduced impulsivity was significantly different from zero according to the Sobel test ($z = 2.21$, $p < .05$). Reduced impulsivity mediated 6.3% of the association between attending AA and reduced DWI.

We identified three independent mediators of the association between longer duration of AA attendance and reductions in DWI: decreases in drinking-related problems (AOR = 0.93, 95% CI [0.88, 0.98]), alcohol-dependence symptoms (AOR = 0.95, 95% CI [0.91, 0.99]), and drinking to reduce

tension (AOR = 0.60, 95% CI [0.50, 0.74]). When duration of AA and the three mediators were entered together to predict DWI, the association of AA duration with reduced DWI was weaker but still significant (AOR = 0.97, 95% CI [0.96, 0.98]), and decreases in drinking-related problems (AOR = 0.92, 95% CI [.88, .97]), alcohol-dependence symptoms (AOR = 0.95, 95% CI [0.91, 0.99]), and drinking to reduce tension (AOR = 0.60, 95% CI [0.50, 0.74]) remained significant predictors (Figure 3). The indirect effects of duration of AA on DWI at 1 year via drinking-related problems, alcohol-dependence symptoms, and drinking to reduce tension were significantly different from zero according to the Sobel test ($z = 4.68$, $z = 6.66$, and $z = 7.56$, respectively, $ps < .001$). Reductions in drinking problems, alcohol dependence, and drinking to reduce tension mediated 19.2% of the association between attending AA for a longer duration and reduced DWI.

Changes in functioning and life context during Year 1 did not mediate between duration of AA attendance during Year 1 and DWI at 16 years. Changes in functioning and life context during Years 2-3 also did not mediate between duration of AA during Years 2-3 and DWI at 16 years.

Social support changes during Years 2-3 mediate between AA in Year 1 and DWI at 16 years

As previously noted, a longer duration of AA during Year 1 was associated with less DWI at 16 years (Table 2); increases in social support frequency during Years 2-3 were also associated with a lower likelihood of DWI at 16 years. Therefore, we considered whether increases in social support frequency during Years 2-3 mediated between duration of AA during Year 1 and DWI at Year 16. A longer duration of AA during Year 1 predicted greater increases in social support during Years 2-3 ($B = 0.093$, $p < .05$). When AA duration and social support were entered together, the association of AA duration with reduced DWI was still significant (AOR

FIGURE 3. Mediators of duration of Alcoholics Anonymous (AA) attendance (between baseline and 1 year) and driving while intoxicated (DWI) at 1 year (controlling for age, family income, and baseline DWI). Values shown are unstandardized regression coefficients.

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

= 0.97, 95% CI [0.96, 0.99]), and increased social support (AOR = 0.99, 95% CI [0.96, 0.99]) remained a significant predictor. The indirect effect of a longer duration of AA attendance during Year 1 on DWI at 16 years via increases in social support between Year 1 and Year 3 was significantly different from zero according to the Sobel test ($z = 1.99$, $p < .05$).

Discussion

At baseline, 60% of individuals with untreated alcohol use problems had driven while intoxicated during the previous 6 months. Sixteen years later, this percentage had dropped to 14% among individuals who were followed.

Treatment, AA, and DWI

Compared with those who reported no DWI, individuals who reported DWI at baseline (Domain II), either infrequently or often, were more likely to attend AA but were no more likely to obtain treatment during the first follow-up year (Domain III). The DWI groups attended AA over a longer duration within the first year than did the group that did not engage in DWI. More outpatient treatment—that is, attending sessions for a longer duration—during Year 1 was associated with a lower likelihood of DWI at the 1-year follow-up, as was attending AA and attending for a longer duration. Furthermore, a longer duration of AA attendance

between baseline and 1 year, and between 1 and 3 years, was associated with a lower likelihood of DWI at 16 years.

By specifically including the outcome of a lower likelihood of relapse to DWI, our findings extend those of other studies in which more alcohol-related specialty care (McKay, 2009; Moos et al., 1999; Ritsher et al., 2002) and AA participation (Kaskutas et al., 2008; Timko and DeBenedetti, 2007) were associated with better drinking outcomes (e.g., abstinence) in general. They concur with conceptual models hypothesizing that a longer duration of help may reduce the risk of impaired driving among individuals prone to drive while intoxicated (Mann et al., 1983; Wells-Parker and Williams, 2002).

Personal functioning and life context associated with DWI

Like others using community samples or samples of individuals convicted and treated for DWI (Hoffmann et al., 1987; Johnson et al., 1998), this study of first-time help-seekers found that individuals who drove while intoxicated, either infrequently or often, were younger and had a higher family income. DWI is positively related to income because of the necessity of having sufficient resources to own or access a vehicle for the behavior to occur (Keyes and Hasin, 2009).

Adding to findings on concurrent associations of personal functioning and life context factors with DWI, this study showed that improved drinking, psychosocial functioning,

and coping (Domains I-IV) were related to decreased risk of subsequent DWI (Domain V). A broad array of early (between baseline and 1 year) changes in functioning and life context was associated with decreased risk of DWI at 1 year; a small subset of these characteristics predicted decreased risk of DWI at 16 years. Specifically, increases in drinking self-efficacy and decreases in days spent intoxicated predicted decreased risk at 16 years. Abstinence self-efficacy is a consistent predictor of positive drinking-related outcomes (Adamson et al., 2009). The benefits of self-efficacy appear to extend to less driving after drinking (Freeman et al., 2005).

Decreased depression between baseline and 1 year predicted less DWI at 16 years. Evidence supports possible links among depression, motivation to change, and outcomes of help, such that problem drinkers with higher levels of depression may be more receptive and responsive to help obtained (Blume et al., 2001; Crum et al., 2001; Holt et al., 2009). Experiencing fewer negative life events and relying more on problem-solving coping in the short term also predicted less risk of DWI in the long term. Similarly, among individuals treated for alcohol use disorders, increases in approach coping during treatment were associated with fewer subsequent alcohol-related problems (Chung et al., 2001).

Mediators between help and DWI

We identified mediators of part of the association between AA participation and reduced DWI at 1 year, including a decline in impulsivity. Because participation in AA may be associated with a decline in impulsivity (Blonigen et al., 2009) and because mutual-help groups encourage lifestyle changes encompassing greater structure, organization, and planning in daily routines (Moos, 2007, 2008; Morgenstern et al., 1997), such mechanisms of action may reduce individuals' impulsivity and thereby lead to a decline in impulsive behaviors such as DWI. Decreases in drinking-related problems and drinking to reduce tension explained part of the association between more extended participation in AA and reduced DWI at 1 year. In addition, increases in social support reported at Year 3 explained part of the association between extended participation in AA during Year 1 and reduced DWI at Year 16.

Drinking problems and coping motives for drinking, such as use of alcohol to reduce discomfort or anxiety, are important predictors of drinking behaviors (Blume et al., 2006; Carrigan et al., 2008). In addition, shifts to more active coping responses, as well as enhanced friendship networks, mediate between more mutual-help participation and better substance use outcomes (Humphreys et al., 1999; Humphreys and Noke, 1997; Kaskutas et al., 2002). When more reliance on adaptive coping is internalized through AA participation and social supports are enriched, positive cycles

may develop such that reduced consequences from alcohol and drug use disorders, active coping, and abstinence and its benefits (e.g., cessation of DWI) continually reinforce each other (Humphreys et al., 1999).

Our findings underscore the need for multifactorial models to understand the interplay of personal and psychosocial characteristics that increase the risk of DWI and its consequences (Donovan et al., 1990; Nochajski and Stasiewicz, 2006). By showing that participation in outpatient treatment and AA is associated with a reduction in DWI and by examining mediators of these associations, our findings contribute to the development of integrated conceptual models needed to understand and deter DWI.

Limitations and conclusions

This study used a naturalistic, self-selection design. Accordingly, the differences shown according to DWI history at baseline, and predictors of subsequent DWI, may be the result of self-selection and motivation to obtain help, as well as the effects of personal characteristics or participation in outpatient treatment or AA. Additionally, although some analyses presented here used predictors that occurred before the DWI outcomes examined, other analyses used predictors and outcomes captured 1 year after baseline, making it impossible to determine the direction of effects. Another limitation is that we obtained information only on 6-month windows of DWI at each follow-up, and therefore we cannot trace the complete status on the impaired driving of participants over the 16-year interval. In addition, our data were based on self-report, which may provide more opportunity, compared with face-to-face assessments, for less-than-accurate self-disclosure. However, self-reported alcohol-related outcomes appear to be reasonably valid, especially when they are obtained independently of treatment providers and with assurance of confidentiality, as was the case here (Babor et al., 2000). Self-reports of DWI may underreport actual number of occurrences of DWI (Chang and Lapham, 1996) but have some advantage over objective measures (e.g., police citations, court records), in that the vast majority of drunk driving is never detected or entered into administrative databases (LoCastro et al., 2008).

Our results suggest the possibility that individuals who have engaged in DWI and are seeking alcohol-related help for the first time may reduce their risk of repeated DWI when they sustain participation in outpatient treatment or AA. In addition, because people with a DWI history who sought help were more likely to have psychological symptoms, this population may respond well to interventions, such as AA, that offer opportunities to address not only drinking but also psychological factors such as impulsivity, coping choices, and depression symptoms that may exacerbate the risk of DWI (Wells-Parker and Williams, 2002). The findings imply that more and sustained mutual

help for alcohol use disorders may be associated with better DWI outcomes via fewer drinking consequences as well as improved psychosocial functioning and coping among previously untreated individuals.

In addition to clinical implications, this study has implications for public policy regarding DWI. Our findings of associations between a longer duration of outpatient treatment and AA over the first year and reduced DWI at the 1-year follow-up, and between longer AA attendance over the first 3 years and reduced DWI at the 16-year follow-up, raise the question of whether mandated, rather than voluntary, treatment and AA would show the same short- and long-term benefits. Although this study did not address mandates, prior studies suggest that mandates are effective. For example, patients who were mandated to treatment by the justice system experienced similar therapeutic gains and satisfaction during treatment and as good or better 1-year and 5-year substance use and functioning outcomes, as did patients who were involved in the justice system but were not mandated to treatment (Kelly et al., 2005).

With regard to AA, a large study of people seeking substance use disorder treatment found that the AA experiences of individuals who had never been court mandated to AA were similar to those of individuals whose AA attendance was at least partially the result of a court mandate (Humphreys et al., 1998). Similarly, the majority of offenders in drug treatment court reported no difficulty in completing the key requirement of attending AA meetings (Turner et al., 2002). Hence, an individual who is court mandated to treatment or AA should be a good candidate for positive outcomes, although an associated reduction in DWI over the long term has not yet been a focus of such research.

Future evaluations of mandated treatment and AA to reduce DWI over the long term should consider that the justice system often does not distinguish between different types of help (e.g., professional treatment, mutual help) or, in the case of professional treatment, its orientation (e.g., 12 step, cognitive-behavioral) (Taxman and Bouffard, 2002). However, it is important to assess and analyze these factors, along with the amount and intensity of help received, to understand their impact on drinking and driving behaviors. For example, the frequency with which individuals engage in DWI may moderate the effects of the amount and intensity of treatment or AA on subsequent drinking and driving behaviors. Generally, individuals with highly chronic and severe substance use problems have better outcomes when they receive more (and more intensive) treatment, whereas individuals with milder problems tend to improve whether they receive lower or higher amounts and intensities of help (Blonigen et al., 2009; Chen et al., 2006; McKay, 2009). Accordingly, future research should recognize that treatment and AA participation, whether mandated or voluntary, may not be sufficient for some people who repeatedly engage in DWI to desist such behavior (DeYoung, 1997).

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