Original Investigation

Chronic Care Management for Dependence on Alcohol and Other Drugs
The AHEAD Randomized Trial

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IMPORTANCE People with substance dependence have health consequences, high health care utilization, and frequent comorbidity but often receive poor-quality care. Chronic care management (CCM) has been proposed as an approach to improve care and outcomes.

OBJECTIVE To determine whether CCM for alcohol and other drug dependence improves substance use outcomes compared with usual primary care.

DESIGN, SETTING, AND PARTICIPANTS The AHEAD study, a randomized trial conducted among 563 people with alcohol and other drug dependence at a Boston, Massachusetts, hospital-based primary care practice. Participants were recruited from September 2006 to September 2008 from a freestanding residential detoxification unit and referrals from an urban teaching hospital and advertisements; 95% completed 12-month follow-up.

INTERVENTIONS Participants were randomized to receive CCM (n=282) or no CCM (n=281). Chronic care management included longitudinal care coordinated with a primary care clinician; motivational enhancement therapy; relapse prevention counseling; and on-site medical, addiction, and psychiatric treatment, social work assistance, and referrals (including mutual help). The no CCM (control) group received a primary care appointment and a list of treatment resources including a telephone number to arrange counseling.

MAIN OUTCOMES AND MEASURES The primary outcome was self-reported abstinence from opioids, stimulants, or heavy drinking. Biomarkers were secondary outcomes.

RESULTS There was no significant difference in abstinence from opioids, stimulants, or heavy drinking between the CCM (44%) and control (42%) groups (adjusted odds ratio, 0.84; 95% CI, 0.65-1.10; *P*=.21). No significant differences were found for secondary outcomes of addiction severity, health-related quality of life, or drug problems. No subgroup effects were found except among those with alcohol dependence, in whom CCM was associated with fewer alcohol problems (mean score, 10 vs 13; incidence rate ratio, 0.85; 95% CI, 0.72-1.00; *P*=.048).

CONCLUSIONS AND RELEVANCE Among persons with alcohol and other drug dependence, CCM compared with a primary care appointment but no CCM did not increase self-reported abstinence over 12 months. Whether more intensive or longer-duration CCM is effective requires further investigation.

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Alcohol and other drug dependence can be chronic diseases, but they are usually treated episodically.[1] Few seek treatment,[2] and most who do do not complete it.[3] Barriers to care range from impaired motivation to seek help to health care organizational impediments, including poor coordination of care for common co-occurring conditions.[4,5]

Treatments for substance dependence, particularly longitudinal ones, have efficacy.[6] Although primary care settings are designed to address most health care needs with longitudinal, comprehensive, and coordinated care and are therefore logical settings in which to manage chronic illness like addiction, they have not adequately addressed substance dependence.[5] The main approach to care—referral to addiction treatment programs—has been unsuccessful largely because patients do not go to them.[4]

Chronic care management (CCM) has efficacy for chronic medical and mental health conditions.[7-12] Current health care reform approaches to improving care quality and lowering costs for patients with chronic illness have turned to CCM as a solution.[13,14] The focus for implementation has been the primary care patient-centered medical home.[15] Chronic care management is multidisciplinary patient-centered proactive care, a way to organize services that provides coordination and expertise, and has been effective for depression, medical illnesses, and tobacco dependence (a substance use disorder).[9-12] Trials of integrated medical and addiction care have shown some success and suggest that CCM has potential for addiction,[16-19] particularly since care elements long known to be effective for addiction overlap with CCM approaches. We have made the case for why CCM should be implemented in primary care and be effective,[7] but no large randomized trials have been published testing the effectiveness of CCM in primary care for substance dependence.[18]

ASI *Addiction Severity Index*

CCM *chronic care management*

CDT *disialocarbohydrate-deficient transferrin*

CIDI-SF *Composite International Diagnostic Interview Short Form*

GGT *γ-glutamyltransferase*

NCM *nurse care manager*

SF-12 *12-Item Short Form Health Survey*

SIP *Short Inventory of Problems*

Methods

Study Design

The Addiction Health Evaluation and Disease Management (AHEAD) study was a randomized trial comparing the effect of CCM vs usual primary care for patients with alcohol or drug dependence. The study was originally designed as 2 trials—a study of CCM for alcohol dependence and a study of CCM for drug dependence. For efficiency in implementation and to maximize power, the studies were implemented as 1 trial enrolling participants with alcohol or drug dependence.

Participants

Study participants were recruited from September 2006 to September 2008 from a freestanding residential detoxification unit (n=416; 74%), referrals from an urban teaching hospital and advertisements (n=53 outpatient, n=4 emergency department, n=2 hospital inpatient, and n=88 advertisements and other referrals; 26%).

Inclusion criteria were (1) age 18 years or older; (2) alcohol dependence (determined by the Composite International Diagnostic Interview Short Form [CIDI-SF])[20] and heavy drinking in the past 30 days (for men, ≥5 drinks [13.7 g of ethanol each] on 1 occasion at least twice or ≥22 drinks/wk in an average week; ≥4 drinks on 1 occasion at least twice or ≥15 drinks/wk for women) or CIDI-SF diagnosis of drug dependence and past 30-day use of psychostimulants (cocaine, methamphetamine, or prescription amphetamine misuse) or heroin or prescription opioid misuse (with misuse defined as use without a prescription, in larger amounts than prescribed, or for a longer period than prescribed); and (3) willingness to continue or establish primary care at an urban hospital-based practice. Exclusion criteria were (1) inability to be interviewed due to acute illness; (2) breath alcohol level of 100 mg/dL or higher (Alco-sensor IV Breathalyzer; Intoximeter Inc); (3) inability to provide contact information for 2 persons; (4) lack of fluency in English or Spanish; (5) cognitive impairment (score <21 of 30 on the Mini-Mental State Examination)[21]; and (6) pregnancy.

Participants provided written informed consent and received compensation. The Institutional Review Board of Boston University Medical Campus and Boston Medical Center approved the study, including follow-up of incarcerated participants, and we obtained a Certificate of Confidentiality from the National Institutes of Health. Participants were compensated on completion of study procedures (not for any clinical visits) ($35 at baseline, $50 at 3-month, $50 at 6-month, and $75 at 12-month research contacts), and $2 each time they updated their contact information. Participants were offered a meal and reimbursement for transportation at each study visit.

Assessment at Baseline

The baseline interview assessed demographics (including race/ethnicity by self-report), 30-day timeline follow-back for alcohol use,[22] Addiction Severity Index (ASI; range, 0-1; 1 is greatest severity),[23] Short Inventory of Problems (SIP-2R; range, 0-45; higher score indicates more/more frequent problems),[24] Short Inventory of Problems–Drugs (SIP-D; range, 0-45),[25] visual analog scales for readiness to change (range, 1-10; 10 indicates greater readiness),[26] 12-Item Short Form Health Survey (SF-12; see Outcomes section of Methods for ranges),[27] depressive symptoms on the 9-item Patient Health Questionnaire (range, 1-28; ≥10 is consistent with a depression diagnosis),[28] sex and drug risk behaviors on the HIV Risk Assessment Battery (range, 1-33; higher scores represent more risk behaviors),[29] health care utilization,[30] and medical comorbidity (any vs none).[31] To encourage truth telling and discourage enrollment of ineligible persons, participants enrolled outside of the detoxification unit had breath alcohol testing and, if they reported drug dependence and recent use, saliva drug testing (see below).

Randomization

After the baseline assessment and via a central secure website (providing allocation concealment), participants were randomly assigned in a 1:1 ratio to receive either the CCM intervention or usual primary care as a control condition using random permuted blocks of sizes 6 and 8 stratified by dependence and recent use status (ie, alcohol, drug, or both).

Chronic Care Management

Chronic care management for substance dependence was delivered at the AHEAD study clinic located in a primary care clinic. Chronic care management included longitudinal care for substance dependence and related medical and psychiatric comorbidities and coordination of specialty medical, psychiatric, and addiction care with primary medical care as needed, facilitated by a shared electronic health record that had specifically created forms. Clinicians maintained a registry and proactively reengaged patients who missed follow-up for any reason.

The AHEAD clinic was staffed by a multidisciplinary team separate from any primary care staff, including a nurse care manager (NCM), a social worker, and internists (who did not deliver primary care for these participants) and a psychiatrist with addiction expertise. All clinic staff were on site 2 half-days a week for new and follow-up visits. The NCM and social worker were on site the remaining weekdays; physicians were available for consultation.

Intervention participants were asked to attend 2 AHEAD clinic visits (90 minutes each), separated by 3 to 4 days, receiving substance use, psychiatric, medical, and social assessments by all 4 clinicians. The main focus of these visits was to engage participants so they would return for ongoing care. Treatments for addiction and for medical and psychiatric conditions were begun depending on participants' diagnoses and readiness/priorities. Clinicians were provided with the CIDI-SF and 9-item Patient Health Questionnaire results but no other research assessment results. Participants were escorted to their first visit as soon as possible after randomization. Participants were offered 4 sessions of motivational enhancement therapy with a social worker (who used the Mini-Mental State Examination, SIP, and liver enzyme measurements for patient feedback),[32] relapse prevention counseling at every contact by whichever clinician they saw, usually the NCM or social worker (which includes assessment of substance use),[33] a primary care appointment, and referral to specialty addiction treatment and mutual help groups, all tailored to clinical needs and patient preferences. Addiction pharmacotherapy (naltrexone, acamprosate, disulfiram, buprenorphine, and referral for methadone) and psychopharmacotherapy were offered as appropriate.

Continuing care was delivered during the follow-up period, including clinic visits, NCM contacts by telephone, facilitated referrals to addiction specialty care, drop-in care, and 24-hour pager access. Because participants had varied diagnoses, severity, priorities, and readiness for treatments, care was individualized and there was no set number of visits (which could be counterproductive if required against a participant's desires). In general, however, it was common for participants to return in a week after the first 2 visits to check on progress, complete paperwork needed for social services, transition to additional addiction treatment, begin addiction or psychiatric pharmacotherapy, and/or receive addiction or mental health counseling. If patients did not appear for visits for a month, the NCM contacted them to reengage.

Usual Primary Care

Participants in the control group were given a timely appointment with a named primary care physician and a list of addiction treatment resources. They had no access to the AHEAD clinic. They were also given a telephone number to access 4 motivational enhancement therapy sessions. The rationale for this access was to have all services available to both groups so the trial would test CCM, not specific clinical interventions, and motivational enhancement therapy was not routinely available outside the study; 9 control participants (3%) had a session.

Participant Assessment at Follow-up

Assessments were conducted at 3, 6, and 12 months after enrollment, usually in person. The last participant follow-up assessment was on January 21, 2010. At 6 months, percent disialocarbohydrate-deficient transferrin (CDT) and γ-glutamyltransferase (GGT) tests were done, and saliva and hair samples were tested for drugs (saliva for opioids, cocaine, methamphetamines, benzodiazepines, and tetrahydrocannabinol by enzyme-linked immunosorbent assay [Friends Medical Laboratory Inc] within a 1- to 3-day window[34]; hair for opioids and cocaine by enzyme-linked immunosorbent assay and gas chromatography–mass spectroscopy [Psychemedics Corp] within a 90-day window).

In the first year of the study, CDT and GGT measurements were obtained only for those with baseline heavy alcohol use and dependence, and hair and saliva were tested for those with drug use and dependence; thereafter, all were tested because it became financially feasible to do so and having data on all subsequent participants was thought to be better than not having it.

Outcomes

The primary outcome was self-reported 30-day abstinence from stimulants, opioids, and heavy alcohol use (four or more 13.7-g ethanol drinks for women and ≥5 drinks for men in a day) at 3, 6, and 12 months. Stimulant (cocaine, amphetamine) and opioid (heroin, other opioid misuse) use were assessed by the ASI.[23] Alcohol use was assessed using the 30-day timeline follow-back calendar method.[22] Additional outcomes of particular interest were 30-day abstinence from stimulants, opioids, and any alcohol use; alcohol and drug problems (measured by the SIP-2R and SIP-D); any hospitalization; and any emergency department visits. Other outcomes were CDT 1.7% or higher, GGT 66 IU/L or higher; detection of opioids or cocaine by hair testing and detection of cocaine, opioids, or methamphetamine by saliva testing; alcohol and drug addiction severity (measured by the ASI); number of heavy drinking days; health-related quality of life (SF-12 Mental Component Sum-

mary [MCS] and Physical Component Summary [PCS] scores; range, 0-100; 100 represents best health); and addiction treatment utilization (including mutual help group meeting attendance [eg, Alcoholics Anonymous, Narcotics Anonymous], inpatient or outpatient addiction treatment, and medication for addiction [eg, buprenorphine, methadone, naltrexone, acamprosate, disulfiram]).

Statistical Analysis

Although longitudinal regression models were used in the analyses, for the purposes of power calculations a simpler setting using a single time point was considered (we anticipated that this was conservative because the power for the longitudinal analysis would be higher). It was assumed that 30% of control group participants would be abstinent at follow-up. This estimate was based on both the literature[6,16,17,35] and a previous randomized clinical trial conducted by the authors testing the effectiveness of a multidisciplinary clinic at a detoxification unit.[36] We hypothesized that the proportion in the intervention group with abstinence would be 50% (ie, an absolute difference of 20% between groups). Allowing for 25% attrition from 320 participants in each of the alcohol and drug dependence subgroups, the study provided 86% power to detect a 20% between-group difference in the proportions with abstinence from drug and heavy alcohol use for each subgroup (2-sided α=.05), The study was therefore expected to have greater power to detect the same effect size in the full sample. Recruitment did not continue to the originally planned 640 participants because some participants had both alcohol and drug dependence. The combined study exceeded the originally planned sample sizes (and follow-up rates) for each of the separate subsamples (n=413 with alcohol dependence; n=465 with drug dependence).

The primary outcome was analyzed using generalized estimating equation (GEE) logistic regression models adjusting for dependence and recent use status (alcohol, drug, or both, the randomization stratification variable) and time. The time-averaged effect of the intervention was the main interest in this study, and the results reported in the primary analyses are main effects from models that do not include interaction terms. An independence working correlation was used and empirical standard errors are reported for all GEE analyses. Confirmatory analyses were performed adjusting for race and depressive symptoms, 2 factors that differed significantly between groups at baseline. Additional binary outcomes were analyzed using the same approach. For the continuous outcomes of SF-12 Mental and Physical Component Summary scores, we fit linear mixed-effects regression models. Number of heavy drinking days was analyzed using GEE overdispersed Poisson models.

For alcohol and drug problems (SIP-2R and SIP-D scores) and for ASI drug and alcohol scores, the distributions were nonnormal and appropriate transformations were not found. Therefore, SIP-2R and SIP-D scores, nonnegative integers, were analyzed using GEE overdispersed Poisson models because the variance exceeded the mean. Confirmatory analyses were also performed using negative binomial regression models and linear mixed-effects models, and the results were consistent across all models for both the SIP-2R and SIP-D scores. For ASI drug and alcohol scores, each outcome was categorized into multiple ordered categories and analyzed using GEE proportional odds models. Biological outcomes were analyzed using logistic regression models.

All analyses were conducted on an intention-to-treat basis, wherein study participants were analyzed according to randomized group regardless of whether they received their assigned intervention. Missing data were not imputed; only the observed data were used. However, a sensitivity analysis was conducted using multiple imputation to address missing follow-up data for the primary outcome of abstinence from stimulants, opioids, and heavy alcohol use. Baseline variables used in the imputation were dependence and recent use status (alcohol, drug, or both), randomized group, age, sex, and race. A priori–defined subgroup analyses for the above outcomes were conducted among those with alcohol dependence and those with drug dependence.

In post hoc–defined subgroups, we analyzed intervention effects among baseline opioid and stimulant users in the drug dependence subgroup separately. In analyses of the primary outcome, we also tested interactions between the intervention and time, medical comorbidity, substance abuse–related medical comorbidities, intention to change alcohol or drug use, homelessness, SF-12 Mental Component Summary score, addiction treatment in past 3 months, and recruitment site, but there were no meaningful interactions (eTables 1-4 in the Supplement). In an exploratory analysis, we tested the effect of the number of AHEAD clinic visits using the longitudinal regression models described above. All analyses were conducted using 2-sided tests and a significance level of $P<.05$. Statistical analyses were performed using SAS version 9.2 (SAS Institute Inc).

Results

Enrollment and Follow-up

Of the 2029 people screened, 1374 were ineligible (**Figure**). Of the 655 eligible participants, 563 (86%) were randomized. At least 1 follow-up interview was conducted for 98% (553/563) of participants (no significant difference between groups). Baseline characteristics of the study participants (**Table 1**) were similar between randomization groups but differed significantly for race and depressive symptoms. Both groups improved over time on a number of measures.

Receipt of the Intervention

Of the 282 participants assigned to the intervention group, 281 (99.6%) attended at least 1 CCM clinic visit, 75.9% attended at least 2, and 64.5% attended 3 or more visits (median, 6 visits; interquartile range, 2-16 visits). Most reported scores consistent with receipt of high-quality CCM at 12 months (75% had scores ≥3.3 on a scale adapted to assess addiction CCM; possible range, 1-5).[37] Most (62%) received 1 or more motivational enhancement therapy sessions and 27% completed 4 sessions.

Figure. Participant Flow

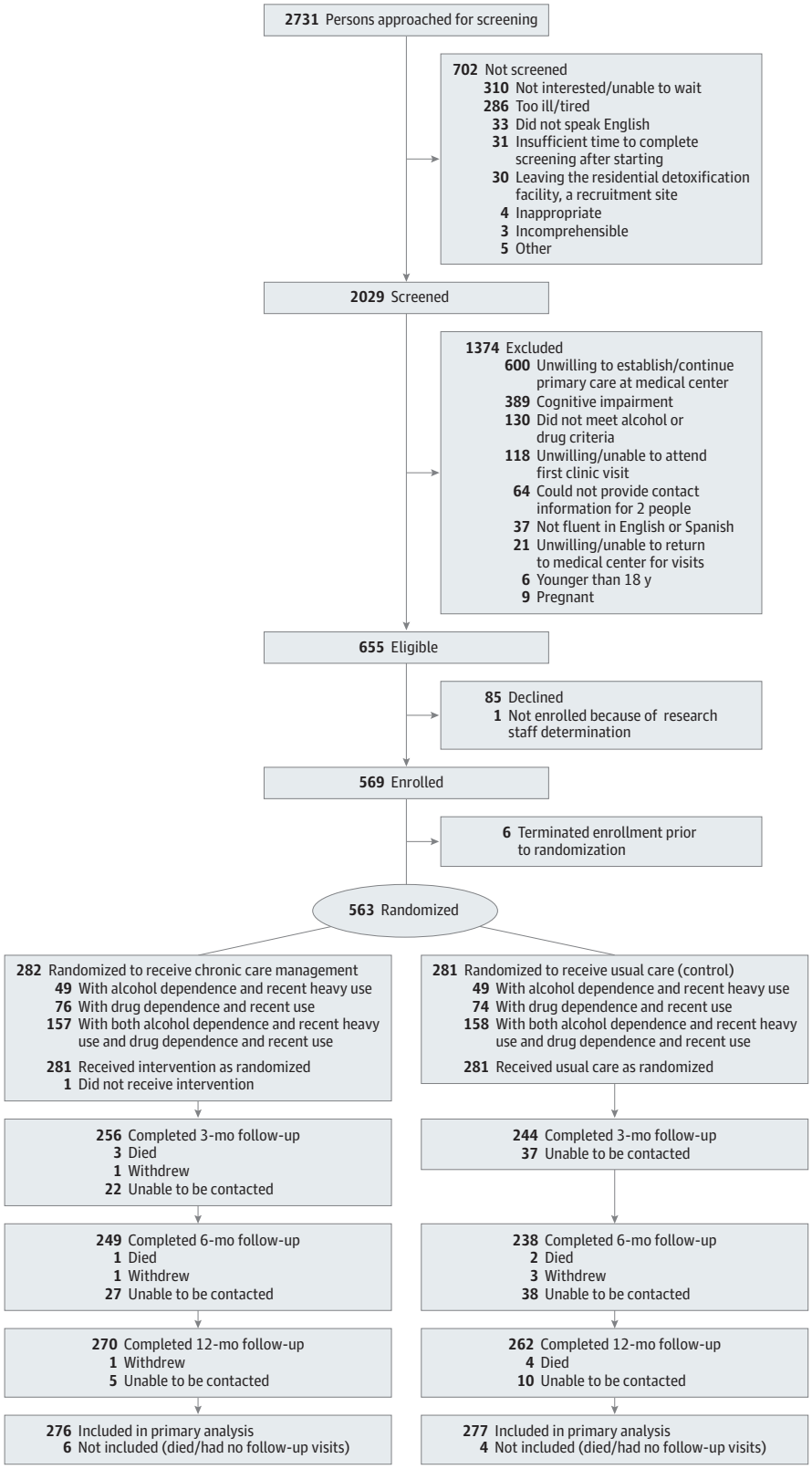

Table 1. Characteristics of Study Participants With Alcohol or Other Drug Dependence at Baseline and at 12 Months[a]

Characteristics	Baseline			12-Month Follow-up		
	Overall (n=563)	Intervention (n=282)	Control (n=281)	Overall (n=532)	Intervention (n=270)	Control (n=262)
Age, mean (SD), y	38 (10)	39 (10)	38 (11)			
Female	154 (27)	84 (30)	70 (25)			
Race/ethnicity[b]						
White	264 (47)	132 (47)	132 (47)			
Black	179 (32)	93 (33)	86 (31)			
Hispanic	75 (13)	28 (10)	47 (17)			
Other	45 (8)	29 (10)	16 (5)			
Education						
Less than high school	133 (24)	73 (26)	60 (21)			
High school	277 (49)	137 (49)	140 (50)			
Beyond high school	153 (27)	72 (25)	81 (29)			
Homeless (≥1 night in past 3 mo)	332 (59)	159 (56)	173 (62)	156 (29)	75 (28)	81 (31)
Health insurance	446 (79)	221 (79)	225 (80)	472 (89)	237 (88)	235 (90)
Incarceration						
Ever	439 (78)	224 (80)	215 (77)			
Past 3 mo	95 (17)	55 (19)	40 (14)	114 (21)	59 (22)	55 (21)
PHQ-9 depressive symptoms score ≥10[b,c]	465 (83)	224 (79)	241 (87)	222 (42)	107 (40)	115 (44)
SF-12 MCS mental health–related quality-of-life score, mean (SD)[c]	30 (10)	31 (10)	30 (10)	39 (10)	39 (9)	39 (10)
SF-12 PCS physical health–related quality-of-life score, mean (SD)[c]	42 (8)	41 (9)	42 (8)	43 (8)	43 (8)	42 (8)
Any medical comorbidity[d]	184 (33)	103 (37)	81 (29)			
CIDI-SF dependence[c]						
Alcohol	68 (12)	29 (10)	39 (14)			
Drug	129 (23)	71 (25)	58 (21)			
Both alcohol and drug	366 (65)	182 (65)	184 (65)			
Any heroin use, past 30 d[e]	335 (60)	168 (60)	167 (59)	118 (22)	64 (24)	54 (21)
Any cocaine use, past 30 d[e]	379 (67)	189 (67)	190 (68)	142 (27)	72 (27)	70 (27)
Heavy drinking days, past 30 d, median (IQR)[e]	11 (1-26)	10 (1-26)	13 (1-26)	0 (0-3)	0 (0-3)	0 (0-3)
Readiness to change score, median (IQR)[f]						
Alcohol use	9 (6-10)	9 (6-10)	9 (6.5-10)	4 (0-9)	2 (0-9)	5 (0-9)
Drug use	10 (8-10)	10 (8-10)	10 (8-10)	7 (0-10)	7 (0-10)	7 (0-10)
ASI score, median (IQR)[c]						
Alcohol	0.5 (0.1-0.8)	0.5 (0.1-0.8)	0.5 (0.1-0.8)	0.2 (0-0.3)	0.2 (0-0.3)	0.2 (0-0.4)
Drug	0.3 (0.2-0.4)	0.3 (0.2-0.4)	0.3 (0.2-0.4)	0.1 (0-0.2)	0.1 (0-0.2)	0.1 (0-0.2)
SIP-2R alcohol-related problem score, past 3 mo, median (IQR)[c]	21 (2-34)	20 (1.5-33)	22 (3-35)	0 (0-15)	0 (0-11.5)	1 (0-19)
SIP-D drug-related problem score, past 3 mo, median (IQR)[c]	33 (21-40)	32 (18-39)	33 (22-40)	5 (0-26)	5 (0-24)	5 (0-28)
Overdose requiring medical attention						
Ever	169 (30)	84 (30)	85 (30)			
Past 3 mo	42 (7)	21 (7)	21 (7)	13 (2)	6 (2)	7 (3)
HIV Risk Assessment Battery sex and drug risk behavior score, median (IQR)[c]	7 (5-12)	7 (5-11)	7 (5-12)	5 (2-6)	5 (2-6)	5 (2-7)
Any episode of vaginal or anal sex without a condom, past 3 mo	309 (59)	156 (60)	153 (59)	233 (49)	119 (49)	114 (49)
Any sex in exchange for drugs or money, past 3 mo	191 (34)	102 (37)	89 (32)	92 (18)	46 (17)	46 (18)
Any injecting drug use, past 3 mo	256 (46)	126 (45)	130 (47)	126 (24)	66 (25)	60 (23)

[a] Data are expressed as No. (%) of participants unless otherwise indicated.

[b] $P<.05$.

[c] See Methods section of text for description of scales for the PHQ-9, SF-12 MCS and PCS, CIDI-SF, ASI, SIP-2R, SIP-D, and HIV Risk Assessment Battery.

[d] Medical comorbidity determined by the Katz Comorbidity Index (score range, 0-8 in this sample; any comorbidity = score >0).

[e] Drug use was determined using the ASI; alcohol use by the timeline follow-back method.

[f] Readiness to change was assessed by a visual analog scale of 1 to 10; a higher score represents greater readiness to change.

Main Results

For the primary outcome of abstinence from stimulants, opioids, and heavy drinking, there was no significant difference between the CCM intervention group and the control group (44% vs 42%, respectively, at 12 months; adjusted odds ratio [OR] for intervention vs control across the 12-month follow-up, 0.84; 95% CI, 0.65-1.10; *P*=.21) (**Table 2**). There were also no significant differences in other outcomes.

In the alcohol and drug dependence subgroups (Table 2), there were no significant differences over time except for fewer alcohol problems (measured by the SIP-2R) in the intervention group among those with alcohol dependence (mean score, 10.4 vs 13.1 at 12 months; incidence rate ratio [IRR], 0.85; 95% CI, 0.72-1.00; *P*=.048).

In sensitivity analyses of the primary outcome of abstinence from drugs and heavy drinking using multiple imputation to account for missing observations, no significant difference was observed for the intervention vs control groups (OR, 0.87; 95% CI, 0.71-1.07; *P*=.19).

Opioid and Stimulant Subgroups

Among those with drug dependence and recent use of opioids (n=369), the intervention was associated with a lower odds of opioid abstinence throughout follow-up (52% vs 54% at 12 months; OR, 0.71; 95% CI, 0.51-0.98) but had no effect on days of opioid use (mean, 16.7 vs 14.0 days for intervention and control at 12 months, respectively; IRR, 1.19; 95% CI, 0.94-1.52 in an analysis adjusted for baseline use)). Among those with drug dependence and recent use of stimulants (n=364), there were no significant intervention effects on stimulant abstinence (51% vs 55% at 12 months; OR, 0.77; 95% CI, 0.56-1.07) or days of stimulant use (mean, 11.0 vs 12.4 days for intervention and control at 12 months, respectively; IRR, 1.05; 95% CI, 0.81-1.37 in an analysis adjusted for baseline use).

Biological Tests

All biomarker analyses (hair and saliva drug tests, CDT, and GGT at 6 months) showed similar nonsignificant results. These included subgroup analyses by substance dependence as well as separate analyses of baseline opioid and stimulant users in the drug dependence sample). In the full sample, ORs for the association between intervention and a negative test result were 1.20 (95% CI, 0.76-1.90; n=417; 30% in intervention vs 27% in control) for hair, 1.07 (95% CI, 0.70-1.62; n=491; 74% in intervention vs 73% in control) for saliva, 1.27 (95% CI, 0.77-2.08; n=420; 80% in intervention vs 78% in control) for CDT, and 0.92 (95% CI, 0.54-1.54; n=428; 83% in intervention vs 85% in control) for GGT.

Addiction Treatment Utilization

The intervention was significantly associated with greater receipt of addiction treatment and addiction medication but not mutual help group attendance (**Table 3**).

Exposure to Intervention

AHEAD clinic visit exposure was significantly associated with the secondary abstinence outcome (less with 1-2 vs 0 visits; more with ≥3 vs 1-2 visits) but not other outcomes (**Table 4**).

Discussion

This study did not find an effect of CCM for substance dependence on substance use, related consequences (with the exception of a small effect on alcohol problems among those with dependence), health-related quality of life, or acute health care utilization.

Chronic care management has demonstrated efficacy for many medical and mental health conditions. Chronic care management should work for substance dependence because it can help overcome system and individual barriers to care (eg, uncoordinated services in separate locations and systems; impaired motivation to seek help; mental and physical comorbidities). Components of CCM have been effective for addictions (eg, case management, co-location, and integration of care),[7] but CCM for addiction in primary care has not been tested in a randomized trial.[18] Willenbring and Olson[16] demonstrated efficacy (abstinence, mortality) of co-location of care for medically ill veterans with alcoholism in a special alcohol clinic. Weisner et al[17] demonstrated efficacy (abstinence) of delivering primary medical care at an addictions treatment program for a subgroup of patients with substance abuse-related medical conditions. In a secondary analysis at 5 years, integrated care was associated with abstinence or use without problems in the whole sample.[38]

Chronic care management has been described as including 6 elements, all of which are represented in the AHEAD clinic and are elements in which staff were trained: use of community resources, making the chronic illness and its management the priority, self-management support, delivery system design, decision support, and use of clinical information systems.[7-10,39] The social worker addressed or connected patients to community services to assist with legal, social, and financial needs. She and the NCM connected patients to addiction treatment and mutual help groups in the community with the ability for "warm handoffs" by knowing individuals who work in or go to those resources. Substance dependence was the focus of the clinic, as documented by specific care plans. Self-management was encouraged by provision of routine assessment and feedback. With psychosocial support from clinic staff, patients were encouraged to participate in their care. Motivational interviewing was used routinely emphasizing the patient's role.

Chronic care management provided on-site services with connections to off-site services, use of patient reminders and planned visits, and multidisciplinary collaboration of team members. Decision support was available through easily accessible expert clinician consultation. Information systems were used to communicate with primary care physicians (outside the AHEAD clinic), for a standard visit template, for a registry function to track patients to encourage follow-up and to track treatments, and to monitor outcomes (eg, substance use). The elements of CCM could be implemented differently or to a greater extent but our and our clinicians' experience suggests that we implemented all of the components. Participant reports were consistent with delivery of high-quality CCM.[37] Nonetheless, future studies could test other ways of

Table 2. Effects of Chronic Care Management Intervention for Substance Dependence on Favorable Addiction Status, Substance Use Problems, Health-Related Quality of Life, and Acute Health Care Utilization[a]

Outcomes	Baseline		12-Month Follow-up		Measure (95% CI)[b]	*P* Value
	Intervention	Control	Intervention	Control		
All Participants	n=282	n=281	n=270	n=262	n=553	
Abstinence from stimulants, opioids, and heavy drinking, past 30 d	NA[c]	NA[c]	120 (44)	109 (42)	0.84 (0.65 to 1.10)[d]	.21
Abstinence from stimulants, opioids, and any drinking, past 30 d	NA[c]	NA[c]	109 (40)	95 (36)	0.89 (0.68 to 1.17)[d]	.40
ASI alcohol score >0.4[e]	170 (60)	175 (63)	53 (20)	58 (22)	1.01 (0.78 to 1.31)[f]	.93
ASI drug score >0.2[g]	205 (73)	208 (74)	58 (21)	54 (21)	0.90(0.71 to 1.14)[f]	.38
Mental health–related quality of life (MCS score), mean (95% CI)	30.8 (29.7-31.9)	30.0 (28.8-31.2)	39.4 (38.3-40.5)	39.1 (37.9-40.3)	−0.14 (−1.49 to 1.21)[h]	.84
Physical health–related quality of life (PCS score), mean (95% CI)	41.4 (40.4-42.4)	42.0 (41.0-42.9)	43.1 (42.2-44.0)	42.4 (41.5-43.4)	0.48 (−0.70 to 1.66)[h]	.42
Any nights in hospital (medical, psychological, detoxification), past 3 mo)	76 (27)	84 (30)	46 (17)	39 (15)	1.07 (0.78 to 1.46)[d]	.67
Any days in emergency department, past 3 mo	146 (52)	158 (56)	81 (30)	80 (31)	0.96 (0.74 to 1.23)[d]	.73
Alcohol Dependence Subgroup	n=206	n=207	n=199	n=195	n=409	
Abstinence from heavy drinking, past 30 d	NA[c]	NA[c]	109 (55)	97 (50)	1.05 (0.78 to 1.43)[d]	.74
No. of heavy drinking days in past 30 d, mean (95% CI)	17.4 (15.9-18.8)	18.6 (17.2-20.0)	5.1 (3.8-6.4)	5.7 (4.4-7.1)	0.95 (0.73 to 1.23)[i]	.69
Alcohol-related problem score, mean (95% CI)[i]	25.1 (23.3-26.9)	26.4 (24.7-28.1)	10.4 (8.5-12.3)	13.1 (11.0-15.1)	0.85 (0.72 to 1.00)[j]	.048
ASI alcohol score >0.4[e]	168 (82)	173 (84)	53 (27)	57 (29)	1.08 (0.80 to 1.45)[f]	.62
Mental health–related quality of life (MCS score), mean (95% CI)	31.2 (29.9-32.5)	30.0 (28.6-31.4)	39.8 (38.5-41.1)	38.7 (37.2-40.1)	0.47 (−1.08 to 2.02)[h]	.55
Physical health–related quality of life (PCS score), mean (95% CI)	41.7 (40.6-42.9)	41.6 (40.4-42.7)	43.1 (42.1-44.1)	42.0 (40.8-43.2)	1.06 (−0.29 to 2.40)[h]	.12
Any nights in hospital (medical, psychological, detoxification), past 3 mo	59 (29)	67 (32)	40 (20)	35 (18)	1.06 (0.74 to 1.50)[d]	.76
Any days in emergency department, past 3 mo	108 (52)	121 (58)	61 (31)	58 (30)	1.00 (0.74 to 1.35)[d]	.99
Drug Dependence Subgroup	n=233	n=232	n=224	n=217	n=458	
Abstinence from stimulants and opioids, past 30 d	NA[c]	NA[c]	117 (52)	111 (51)	0.85 (0.64 to 1.14)[d]	.28
Drug-related problem score, mean (95% CI)[i]	32.1 (30.7-33.4)	33.3 (32.1-34.5)	15.6 (13.6-17.7)	16.0 (13.8-18.1)	1.03 (0.92 to 1.16)[j]	.62
ASI drug score >0.2[g]	202 (87)	204 (88)	57 (25)	54 (25)	0.87 (0.67 to 1.12)[f]	.27
Mental health–related quality of life (MCS score), (mean (95% CI)	30.3 (29.1-31.5)	29.6 (28.4-30.8)	39.1 (37.8-40.4)	39.1 (37.8-40.4)	−0.65 (−2.14 to 0.84)[h]	.39
Physical health–related quality of life (PCS score), mean (95% CI)	41.3 (40.2-42.4)	42.3 (41.2-43.3)	43.3 (42.3-44.3)	42.7 (41.7-43.7)	0.23 (−1.04 to 1.50)[h]	.72
Any nights in hospital (medical, psychological, detoxification), past 3 mo	60 (26)	59 (25)	38 (17)	28 (13)	1.18 (0.83 to 1.66)[d]	.35
Any days in emergency department, past 3 mo	115 (49)	129 (56)	68 (30)	67 (31)	0.86 (0.66 to 1.14)[d]	.30

Abbreviations: ASI, Addiction Severity Index; MCS, Mental Component Summary of the 12-Item Short Form Health Survey (SF-12); PCS, Physical Component Summary of the SF-12.

[a] Data are expressed as No. (%) of participants unless otherwise indicated. Analyses were adjusted for dependence type (alcohol, drug, or both, the randomization stratification variable) and time. Results of analyses adjusting for race and depressive symptoms were similar. Exploratory analyses suggested an interaction between intervention and time (*P*=.05) for the outcome of abstinence from drugs and heavy drinking but not in any hypothesized direction; the intervention group had lower odds of abstinence (drugs and heavy drinking) at 3 months (adjusted OR, 0.69; 95% CI, 0.48-0.99) but no significant differences were observed at 6 or 12 months. No other outcomes had a statistically significant intervention × time interaction.

[b] Corresponds to the main effect of the intervention in models that do not include interaction terms.

[c] Not applicable (NA); all participants reported recent substance use at baseline.

[d] Odds ratio and 95% CIs from generalized estimating equation logistic regression model.

[e] ASI alcohol score >0.4 represents the top 2 of 5 ordered categories used for analysis. Odds ratio is for a 1-category improvement (ie, lower ASI alcohol score) in alcohol addiction severity.

[f] Odds ratio and 95% CIs from generalized estimating equation proportional odds regression model predicting a lower addiction severity score category.

[g] ASI drug score >0.2 represents the top 2 of 5 ordered categories used for analysis. Odds ratio is for a 1-category improvement (ie, lower ASI drug score) in drug addiction severity.

[h] Mean difference and 95% CI between randomized groups from linear mixed-effects regression model.

[i] Alcohol- and drug-related problems were assessed by the Short Inventory of Problems (SIP-2R) and SIP-Drug (SIP-D).

[j] Incidence rate ratio and 95% CI from generalized estimating equation overdispersed Poisson regression model.

Table 3. Effects of Chronic Care Management Intervention for Substance Dependence on Mutual Help Meeting Attendance and Addiction Treatment Utilization[a]

Outcomes	Baseline		12-Month Follow-up		Odds Ratio (95% CI)[b]	*P* Value
	Intervention	Control	Intervention	Control		
All Participants	n=282	n=281	n=270	n=262	n=553	
Any mutual help meeting attendance	136 (48)	133 (48)	147 (54)	147 (56)	0.91 (0.69-1.19)[c]	.49
Any addiction treatment	95 (34)	111 (40)	132 (49)	116 (44)	1.41 (1.09-1.83)[c]	.01
Any inpatient addiction treatment	60 (21)	70 (25)	49 (18)	48 (18)	0.97 (0.73-1.30)[c]	.86
Any addiction medications	13 (5)	20 (7)	58 (21)	39 (15)	1.88 (1.28-2.75)[c]	.001
Alcohol Dependence Subgroup	n=206	n=207	n=199	n=195	n=409	
Any mutual help meeting attendance	103 (50)	94 (46)	106 (53)	103 (53)	1.04 (0.76-1.44)[c]	.79
Any addiction treatment	68 (33)	82 (40)	86 (43)	81 (42)	1.36 (1.01-1.84)[c]	.04
Any inpatient addiction treatment	42 (20)	53 (26)	33 (17)	37 (19)	1.00 (0.71-1.41)[c]	>.99
Any addiction medications	8 (4)	16 (8)	32 (16)	19 (10)	2.12 (1.29-3.48)[c]	.002
Drug Dependence Subgroup	n=233	n=232	n=224	n=217	n=458	
Any mutual help meeting attendance	114 (49)	113 (49)	126 (56)	126 (58)	0.91 (0.68-1.22)[c]	.53
Any addiction treatment	81 (35)	96 (41)	119 (53)	99 (46)	1.47 (1.10-1.96)[c]	.008
Any inpatient addiction treatment	54 (23)	60 (26)	43 (19)	43 (20)	0.96 (0.70-1.31)[c]	.79
Any addiction medications	11 (5)	15 (6)	54 (24)	36 (17)	1.97 (1.30-3.00)[c]	.001

[a] Data are expressed as No. (%) of participants. Outcomes over the previous 3 months were assessed at 3-, 6-, and 12-month follow-up.

[b] Corresponds to the main effect of the intervention in models that do not include interaction terms.

[c] From generalized estimating equation logistic regression model.

implementing CCM for addiction that might have efficacy. For example, self-management and outcome monitoring could be bolstered by routine biomarker testing, visit schedules could be more prescriptive, or specific care pathways more detailed. Future studies should also consider the possibility that CCM is simply insufficient and that more intensive recovery support in the community needs to be added.

Our study, however, suggests that CCM for substance dependence in primary care is not effective, at least not as implemented in this study and population. Several explanations should be considered for these unexpected findings. First, substance dependence treatment has limited efficacy; it may be difficult to detect effects of better delivery of existing treatments. Pharmacotherapy efficacy is varied—it is highly effective for opioid dependence,[40] but for alcohol dependence it yields absolute risk differences for heavy drinking and abstinence of 8% to 11%,[35] and it has no efficacy for stimulants. Psychosocial treatments have efficacy, though these too are varied, and most studies lack no-treatment control groups.[6] Combination psychotherapy yielded a 6% absolute risk improvement in percentage of days abstinent compared with medical counseling.[41] Weiss et al[42] found no detectable benefit of drug counseling over standard medical management of buprenorphine-naloxone. Chronic care management in our study did increase receipt of addiction treatment (by 7%-10%) but this was likely insufficient. We believe that the small increase in use of addiction treatments that are modestly efficacious for only some subsets of people with addictions and limited delivery of evidence-based practices for addiction in the community were likely the main reasons for our findings.

Second, although adherence to treatment is a problem for all people with chronic illnesses, it is particularly important for those with addictions. Most people with addictions do not seek help.[2] Even when they do, their substance use directly affects their motivation and ability to adhere to care. Third, many people with addictions have co-occurring mental health conditions and substantial social problems. Although CCM is designed to address complex problems, it may simply not be enough to overcome the impaired motivation and myriad severe consequences experienced by patients with addictions.

Methodological considerations might also explain the findings. Most study participants were dependent on both alcohol and other drugs, recruited from a detoxification unit, had substantial mental health symptoms, had recently been homeless, and were not necessarily seeking addiction treatment (despite relatively high reported readiness to change their use). The findings may not apply to addiction treatment-seeking or less severely affected populations or to populations recruited elsewhere. Although an effect is plausible, our analyses found no impact on the intervention efficacy of any of these factors. Furthermore, studies of CCM for other conditions have selected severely affected patients with comorbidity and social needs because they are the ones who need the services and could benefit, and these studies have found efficacy.[11] Among people with addictions seeking treatment, favorable outcomes are already good without CCM (eg, 74% with no heavy drinking or problems with alcoholism pharmacotherapy).[41] The need for what CCM offers is greatest for those with severe, complex problems, who are not the easiest to engage in care.

As with prior trials,[16,17] we assessed main outcomes by self-report. Biological tests are inadequate for detecting substance use, particularly when it is not recent. Substance use problems and health-related quality of life are best assessed by self-report. We used validated tools, assured participants

Table 4. Odds Ratios for Abstinence and Favorable Addiction Status in Relation to Number of Visits to Chronic Care Management Substance Dependence Clinic (N=553)[a]

Outcomes	No. (%) at 12 Months	Odds Ratio (95% CI)[b]	*P* Value
Abstinence from stimulants, opioids, and heavy drinking			
0 Visits	109 (42)	1 [Reference]	.07
1-2 Visits	39 (41)	0.64 (0.43-0.96)[c]	
≥3 Visits	81 (46)	0.99 (0.73-1.34)[c]	
Abstinence from stimulants, opioids, and any drinking			
0 Visits	95 (36)	1 [Reference]	.03
1-2 Visits	33 (35)	0.62 (0.40-0.95)[d]	
≥3 Visits	76 (43)	1.08 (0.79-1.46)[d]	
ASI alcohol score >0.4[e]			
0 Visits	58 (22)	1 [Reference]	.23
1-2 Visits	23 (24)	0.76 (0.52-1.09)[f]	
≥3 Visits	30 (17)	1.07 (0.81-1.42)[f]	
ASI drug score >0.2[g]			
0 Visits	54 (21)	1 [Reference]	.33
1-2 Visits	22 (23)	0.76 (0.53-1.10)[f]	
≥3 Visits	36 (20)	0.90 (0.70-1.17)[f]	

Abbreviation: ASI, Addiction Severity Index.

[a] Outcomes over the previous 30 days were assessed at 3-, 6-, and 12-month follow-up. The number of participants with 0 visits at 12 months was 262, 1 to 2 visits was 94, and ≥3 visits was 176.

[b] Corresponds to the main effect of the intervention in models that do not include interaction terms.

[c] Odds ratio and 95% CI from generalized estimating equation logistic regression model adjusting for time point, age, sex, race, homelessness, alcohol- and drug-related problems, physical health–related quality of life, and the 9-item Patient Health Questionnaire for depressive symptoms. For ≥3 visits vs 1 to 2 visits, the odds ratio was 1.54 (95% CI, 1.00-2.38).

[d] Odds ratio and 95% CI from generalized estimating equation logistic regression model adjusting for time point, age, sex, race, homelessness, alcohol- and drug-related problems, physical health–related quality of life, and the 9-item Patient Health Questionnaire for depressive symptoms. For ≥3 visits vs 1 to 2 visits, the odds ratio was 1.74 (95% CI, 1.12-2.71).

[e] ASI alcohol score >0.4 represents the top 2 of 5 ordered categories used for analysis. Odds ratio is for a 1-category improvement (ie, lower ASI alcohol score) in alcohol addiction severity.

[f] Odds ratio and 95% CI from generalized estimating equation proportional odds regression model adjusting for the same covariates predicting a lower addiction severity score category.

[g] ASI drug score >0.2 represents the top 2 of 5 ordered categories used for analysis. Odds ratio is for a 1-category improvement (ie, lower ASI drug score) in drug addiction severity.

of confidentiality, and corroborated main results with biological tests (informing participants of testing) and a range of other outcomes, all of which were consistent.

Low intervention potency seems an unlikely explanation for the results. We implemented all elements of previously successful CCM, trained experienced staff for the study, and provided systems support and ample availability for patients. Uninsurance was not a barrier. Intervention participants had, on average, 6 CCM visits and reported high-quality CCM, and the intervention increased exposure to addiction treatment and pharmacotherapy.

Assessment effects, the list of resources, primary care appointment, or the 3% of controls who received 1 or more motivational enhancement counseling sessions could have biased the study to the null. However, those minimal control group exposures and relatively less intense assessments of 6 hours over a year (compared with longer ones in positive alcohol treatment trials) are unlikely to have had a major effect on a severely affected group.[41] Of note, the whole group improved over time; the change most likely was due to many participants having been enrolled at a detoxification unit, when they were at a more severe point in their addiction and sought some help (a logical time to offer CCM). Assessment effects in treatment trials are inconsistent and poorly understood[43] and often absent in studies of people not seeking treatment.[44] Contamination is also an unlikely explanation of our findings because controls had no access to addiction CCM in the study or elsewhere.

Chronic care management for substance dependence had a small effect on problems among those with alcohol dependence but was ineffective for improving substance use, related clinical outcomes, or health care utilization. Providing more intensive or longer-duration CCM might be effective, or it might be effective for less severe primary care patients or small subgroups of patients with low severity and few comorbidities or social problems who are eager to enter addiction care. It is also possible that the effects of CCM for addiction will not be seen until the health system in which it is implemented is more supportive of integrated care.

Current health care reforms in the United States include a focus on CCM as a solution in patient-centered medical homes to reduce chronic disease burden and to reduce costs (both of which are among the highest for those with addiction), in part because numerous studies have found such benefits for medical and mental health conditions.[14] The model is being widely disseminated in primary care settings by private and government health plans, health care delivery organizations, and health policy leaders anticipating accountable care organiza-

tions and new support for CCM elements. Leading national centers on both CCM[13] and integrated care (www.integration.samhsa.gov) are expanding the model to address substance disorders. In the absence of randomized trials for substance-dependent patients, benefits of CCM are being anticipated and implementation is proceeding. Our findings at least raise the possibility that not all chronic diseases are the same and that CCM may not have the same effect across conditions for which complexity varies, a possibility that should be part of the conversation when models of care are implemented widely. Even though CCM is effective for a number of chronic conditions, it may be premature to assume that CCM will be the solution to improve the quality of care for and reduce costs of patients with addiction. Further research is warranted to determine whether more intensive or longer-duration CCM or CCM designed differently might do so.

Conclusion

In this trial of persons with alcohol and other drug dependence, CCM, compared with a primary care appointment but no CCM, did not decrease use or overall addiction consequences.

ARTICLE INFORMATION

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