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World Health Organization (WHO) Risk Level Reductions in Inpatients with Alcohol Use Disorder and Comorbid Anxiety Disorders

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Abstract

Background and Aims: Studies have demonstrated that reduced drinking without total abstinence is associated with improved outcomes in outpatients with alcohol use disorder (AUD). We sought to examine this question in AUD inpatients who have comorbid anxiety disorders, a common presentation in AUD.

Method: This is a secondary analysis of data from a randomized controlled trial for $N = 241$ inpatients with AUD and comorbid anxiety disorders. Change from baseline drinking level was measured at 1, 4, and 12 months post-discharge, and psychological and functional outcomes were measured at 4 and 12 months post-discharge. Three groups were compared: abstinent, reduced (reduced drinking by 1–3 WHO drinking risk levels without abstinence), or non-reduced (maintained or increased drinking risk level).

Results: At 1, 4, and 12 months post-treatment, most patients reported abstinence (83, 63, and 60%), and 11, 25, and 26% reported drinking at a reduced level. Drinking reductions achieved at 1 month post-treatment were maintained at 12 months post-treatment by 74% of participants. Overall, the abstinent group reported the best psychological and functional outcomes at follow-ups, followed by the reduced group. Few differences were observed between reducers and non-reducers, but reducers reported significantly better alcohol dependence severity and alcohol-related problems than non-reducers.

Conclusions: Though abstinence was associated with the best outcomes in this abstinence-based treatment sample, we conclude that reduced drinking is also associated with significant improvements in alcohol-related outcomes in inpatients with AUD and comorbid anxiety disorders.

Keywords

harm reduction; inpatient; alcohol use disorder; alcohol dependence; treatment outcomes

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INTRODUCTION

For decades, complete abstinence from alcohol has been the primary goal of treatment and measure of recovery from alcohol use disorder (AUD). However, there is evidence that the abstinence-only approach deters patients from seeking treatment (Mann et al., 2017; Witkiewitz, 2013). For example, a nationally representative survey in the U.S. found that not being ready to stop using alcohol was the most common reason adults failed to seek treatment when they perceived they needed it (Park-Lee et al., 2017). Accordingly, there has been extensive consideration of a reduction in alcohol consumption without abstinence (hereafter referred to as "reduced drinking") as a beneficial alternative to complete abstinence in the treatment of AUD (Ashford et al., 2017; Sobell & Sobell, 1995b).

Prior evidence shows that non-clinical young adult samples can achieve and benefit from treatments to reduce drinking (Logan & Marlatt, 2010). In clinical AUD samples, a meta-analysis comparing reduced drinking- and abstinence-oriented treatments found that 58% of patients had substantially reduced drinking in both approaches (Henssler et al., 2021). This meta-analysis, which featured predominantly outpatient samples, demonstrates two points: 1) a relatively high number of outpatients can achieve reductions in drinking, and 2) both reduced drinking and abstinence-based treatments resulted in similar rates of reduced drinking. Further, in outpatient samples, reduced drinking is associated with other positive outcomes on par with abstinence, such as reduced AUD symptoms, improved social functioning, and reduced alcohol-related problems (Collins et al., 2019; Henssler et al., 2021).

A prior study by Witkiewitz et al. (2020) demonstrated that 60–89% of outpatients with AUD achieved reductions in drinking (including abstinence) over 12–16 weeks of treatment. In addition, they found that reductions were associated with improvements in alcohol-related problems, mental health symptoms, and measures of liver functioning. Notably, of those who achieved a drinking reduction post-treatment, 85% maintained the reduction at 1-year follow-up. In that study, reductions were quantified by calculating reductions in WHO drinking risk levels, which are sex-specific categories based on average daily consumption (low, medium, high, and very high; WHO, 2000). Because the field lacks a standard method to measure drinking reductions after treatment, a small but growing number of studies have used WHO drinking risk levels as a standard measure. These studies have shown that reducing drinking by one or two WHO risk levels is associated with reduced risk for cardiovascular disease (Knox et al., 2020), reduced risk of alcohol dependence (Hasin et al., 2017), reduced alcohol-related consequences, improved mental health (Witkiewitz et al., 2017), reduced blood pressure, improved liver functioning, and improved quality of life (Witkiewitz et al., 2018).

However, prior studies supporting the utility of reduced drinking after treatment have either excluded or not segregated patients with comorbid psychiatric diagnoses (Berglund, 2020; Witkiewitz et al., 2020). Given that at least half of people with AUD have comorbid diagnoses (Lai et al., 2015), and these patients experience poorer treatment outcomes (Driessen et al., 2001; Kushner et al., 2005), it is important to examine whether reduced

drinking is a viable goal for the many AUD patients with comorbid diagnoses (Berglund, 2020).

Further, most studies on reduced drinking have examined outcomes following outpatient —rather than inpatient—treatment. For example, in the meta-analysis mentioned above (Henssler et al., 2021), only 5 of the 23 studies examined outcomes following inpatient treatment, most of which are 3–4 decades old (Booth et al., 1984; Booth et al., 1992; Caddy et al., 1978; Meyer et al., 2014; Orford & Keddie, 1986). As a whole, these studies found that patients in controlled-drinking-focused treatments achieved reduced drinking as often as patients in abstinence-focused treatments achieved abstinence. However, these studies focused on measuring and reporting alcohol use rather than psychological or functional outcomes. Further, more recent work is needed to generalize these findings to today's treatment settings.

Although prior studies have found that reduced drinking outcomes were not moderated by AUD severity (Henssler et al., 2021; Witkiewitz et al., 2020), inpatient and outpatient samples likely differ in important ways besides clinical severity. For example, clinicians often use the American Society of Addiction Medicine (ASAM) criteria, which include factors like readiness to change, medical conditions, and living environment, in determining the most appropriate level of care for treatment (ASAM, 2021). Therefore, it is important to test whether AUD inpatients and those with comorbid conditions can achieve and maintain reductions in drinking and whether those reductions are associated with improvements in psychological and functional outcomes.

Using a sample of AUD inpatients with comorbid anxiety disorders who received abstinence-focused treatment, the objective of the current study is to 1) examine the prevalence of WHO risk level reductions and abstinence from baseline to each follow-up, 2) describe maintenance rates for drinking reductions and abstinence at the 12-month follow-up, and 3) compare psychological and functional outcomes between abstainers, reducers, and non-reducers. Finally, 4) we will examine the moderating influence of baseline alcohol dependence severity on reduction maintenance and psychological and functional outcomes.

METHOD

Participants

The current sample was selected from individuals who participated in a randomized controlled trial of cognitive behavioral therapy ($N = 327$; see Kushner et al., 2013). The current sample consisted of 241 participants (73.7%) who completed the first follow-up (at 4 months after treatment) of the parent study. Table 1 compares the baseline measures of those who returned for the 4-month follow-up and those who did not. The two samples did not differ in demographics or baseline WHO level except that the lowest education category (some high school) was overrepresented in those who failed to return for follow-up. Inclusion criteria included current (past 30-day) DSM-IV alcohol dependence, seeking treatment primarily for alcohol-related problems, and at least one of the following: panic disorder, social anxiety disorder, or generalized anxiety disorder. Exclusion criteria were lifetime history of bipolar disorder or schizophrenia, current serious suicidality, current

cognitive impairment affecting the capacity to consent, or inability to read and understand English. The institutional review board approved the study prior to recruitment, and each participant provided informed consent to participate.

Procedure

Participants undergoing residential AUD treatment were randomized to receive one of two six-session study therapies (a CBT designed to address comorbid anxiety-AUD or a stress-management intervention) during their 21-day inpatient treatment stay. Participants completed follow-up assessments of alcohol use and psychological and functional outcomes at 4- and 12-months post-treatment. Alcohol use during the first month post-treatment was also measured at 4-month follow-up. Due to the research team's affiliation with the abstinence-based treatment program, research assistants emphasized to participants that any reports of use at the follow-up appointments would be confidential and not reported to their treatment providers. A more detailed description of the study procedure for the parent study can be found in Kushner et al. (2013).

Measures

WHO Risk Drinking Level Reductions—WHO drinking risk levels were calculated based on reports of daily drinking from the timeline follow back interview (Sobell & Sobell, 1995a) for four time periods: 30 days before treatment (reported at baseline), 30 days following treatment (reported at 4-month follow-up), 30 days prior to 4-month follow-up (reported at 4-month follow-up), and 30 days prior to the 12-month follow-up (reported at 12-month follow-up). Total consumption for each period was converted to grams of alcohol by multiplying by 14 (National Institute on Alcohol Abuse and Alcoholism) and converted to average daily consumption by dividing by 30[1]. WHO levels were as follows: abstinent, low risk (1–20 grams and 1–40 grams for females/males), medium risk (21–40 and 41–60 grams for females/males), high risk (41–60 and 61–100 grams for females/males), and very high risk (>60 grams and >100 grams for females/males; WHO, 2000). To calculate 1-month and 4-month post-treatment level reductions, we subtracted each post-treatment level from the participant's baseline level.

Structured Clinical Interview for the DSM-IV (SCID)—The SCID is a structured interview that assesses the presence and severity of clinical diagnoses and has good interrater reliability (First et al., 2002). In this study, the SCID was used to measure alcohol dependence and severity (using recommended SCID severity criteria), as well as the anxiety diagnoses necessary for inclusion in the original study and major depressive disorder. Values for alcohol dependence severity were initially coded 1 = mild, 2 = moderate, 3 = severe. However, during data analysis, due to few mild cases, we dichotomized this variable (0 = mild/moderate, 1 = severe).

[1]Of note, WHO guidelines indicate that these drinking risk levels were intended to characterize drinking days only (WHO, 2000). However, previous studies of WHO risk levels in clinical samples have calculated levels based on overall average daily consumption, including non-drinking days (e.g., Hasin et al., 2017; Witkiewitz et al., 2018; Witkiewitz et al., 2020). This approach is advantageous for characterizing treatment responses in clinical samples (Hasin et al., 2017). For example, if only drinking days were included, drinking three drinks on one day and abstaining the rest of the month would be classified as the same level of risk as if the person drank three drinks *every day*. Abstinent days would be ignored in the calculation. Hence, we have applied WHO risk levels in the same manner as previous studies with clinical samples and averaged consumption across the past 30 days.

Addiction Severity Index (ASI)—We examined several outcomes for the 30-day period before the 4-month follow-up using the ASI (McLellan et al., 1980). Outcomes included the number of days that the subject reported experiencing alcohol-related problems, serious interpersonal conflicts, and working for pay. Income was measured as total income. Legal problems were measured by the question "How serious do you feel your present legal problems are?" with responses on a 5-point Likert scale (0 = *not at all*, 4 = *extremely*).

Quality of Life—Quality of life was measured by the Quality of Life Enjoyment and Satisfaction (Q-LES) questionnaire, short form (Endicott et al., 1993). Respondents were asked to rate how satisfied they were in five areas of their life over the last week on a scale of 0 (*very poor*) to 4 (*very good*). The five areas were physical health, mood, family relationships, ability to function in daily life, and treatment (only rated if applicable). A mean score was calculated for each participant. The internal consistency of the scale at each time point was: baseline, $\alpha = 0.78$, 4-month follow-up, $\alpha = 0.86$, 12-month follow-up, $\alpha = 0.87$.

Depressive Symptoms—Depressive symptoms were measured by the Beck Depression Inventory (BDI-II), a 21-item survey that measures symptoms of depression (Beck et al., 1996). Respondents rated questions on a scale of 0 to 3, and total scores were calculated (range 0–63). The internal consistency of the scale at each time point was: baseline, $\alpha = 0.87$, 4-month follow-up, $\alpha = 0.88$, 12-month follow-up, $\alpha = 0.93$.

Anxiety Symptoms—Anxiety symptoms were measured using the 'trait' portion of the State-Trait Anxiety Inventory (STAI) for adults (form Y; Spielberger, 1983). This questionnaire asked participants to reflect on how anxious they 'generally' feel on a scale of 0 (not at all) to 3 (very much so). The internal consistency of the scale at each time point was: baseline, $\alpha = 0.91$, 4-month follow-up, $\alpha = 0.94$, 12-month follow-up, $\alpha = 0.92$.

Data Analysis Plan

The analysis plan was not pre-registered, and the results should be considered exploratory. Data and code for analyses are available upon request to the last author (for data) and first author (for code). We screened each outcome for outliers and reduced one outlier for income due to undue influence on results. We used reductions from baseline to the month after treatment to examine the prevalence of level reductions after inpatient treatment. To examine the maintenance of these reductions, we calculated the percentage of people who had initially achieved a reduction at in the first month after treatment who also reported at least that reduction at 12-month follow-up. To examine how drinking reductions related to psychological and functional outcomes, we categorized participants into one of three groups at each follow-up time point: abstinent (reported no alcohol use in the 30 days prior to follow-up period), reduced (reported alcohol use but it was at least 1 WHO level lower than their baseline), or non-reduced (reported alcohol use at or above their pre-treatment WHO level). We examined group differences at 4- and 12-month follow-up using ANOVA analyses using the anova command in Stata 15.1 (StataCorp, 2017). Specifically, group differences were examined for psychological variables: quality of life, depressive symptoms, alcohol dependence severity, alcohol-related problems, and anxiety symptoms,

and functional variables: number of days working, number of days with interpersonal conflicts, legal problems, and total income. Control variables included age, sex (0 = female, 1 = male), baseline alcohol dependence severity (dichotomized due to only 6 mild cases in sample, 0 = mild/moderate, 1 = severe), baseline WHO level, randomly assigned treatment group, and the outcome variable at baseline. Significant group differences were investigated using post-hoc tests (Tukey HSD), and means are displayed in Tables 3 and 4 to indicate the direction of differences.

We added interactions with baseline alcohol dependence severity (0 = mild/moderate, 1 = severe) to examine whether effects were moderated by severity. Interactions were probed using the margins function in Stata to probe simple slopes of the relationship between group (abstinent, reduced, or non-reduced) and the outcome at both levels of the moderator (low or high baseline severity).

RESULTS

Descriptive Statistics

Of the $N = 327$ participants who completed baseline measures, 241 (73.7%) and 222 (67.9%) completed 4-month and 12-month follow-up measures, respectively. Because the drop-out was significant and may have contained a disproportionate number of those drinking at higher levels after treatment, we imputed missing data on predictors and outcomes at 4- and 12-month follow-up using Markov chain Monte Carlo multiple imputation. The results presented in the following sections were unchanged following the imputation of the missing cases, so results presented here are using only original data.

Drinking in the month after treatment was measured at the 4-month follow-up using the TLFB interview. Baseline WHO drinking risk level and alcohol dependence severity were not related to the likelihood of completing follow-up appointments. At baseline, almost all participants had either moderate ($N = 62$, 24.2%) or severe alcohol dependence ($N = 187$, 73.1%) according to SCID severity criteria. As shown in Table 1, most participants were in the “very high” WHO risk category as measured at baseline (73.7%). At all follow-up appointments, the majority of participants who completed follow-up reported abstinence (see Table 2).

In the analyses below, we compared three groups in psychological and functional outcomes: people who reported abstinence at each follow-up (abstinent), people who reported a reduction in drinking at each follow-up compared to their baseline but were not abstinent (reduced), and those who did not reduce their drinking at follow-up compared to baseline (non-reduced).

Prevalence and Maintenance of WHO Risk Level Reductions

Of the 239 people who completed the first follow-up appointment, 199 (83.3%) reported abstinence, 27 (11.3%) reported reductions in WHO risk level without abstinence, and 13 (5.4%) did not reduce their drinking risk level in the first month after treatment (see Table 2). By the 4- and 12-month follow-ups, the number who reduced their drinking without abstinence increased to 60 (24.9% of those who returned for 4-month follow-up) and 59

(26.6% of those who returned for 12-month follow-up). Notably, the number of people reporting abstinence dropped substantially from the first to the 4th month post-treatment (from 83.3% to 62.7%), with 71% of these previous-abstainers moving to the reduced drinking group (44 people) and 29% returning to their baseline level of use (18 people). The result is that almost three-quarters of those classified as reducers at 4-month follow-up were previously abstinent (44 of 60; 73.3%). A complete flow chart of the groups is depicted in Figure 1.

Of those who achieved at least a 1-level reduction in drinking without abstinence from baseline to 1 month after treatment ($N = 27$), 74.1% ($N = 20$) returned and reported that they were still maintaining at least a 1-level reduction at 12-month follow-up. In comparison, 65.7% of those who reported abstinence in the first month after treatment reported abstinence at a 12-month follow-up. Among all participants who achieved at least a one-level reduction in the first month after treatment (including those who were abstinent), maintenance rates at 12-month follow-up did not vary by baseline alcohol dependence severity (one-level: $N = 152$, χ^2: 0.04, $p = .851$).

Outcomes at 4-month Follow-up by Group

Means and standard deviations for all outcomes are reported by group in Table 3. Drinking groups (abstinent, reduced, or non-reduced) were significantly different from one another on all psychological outcomes at 4-month follow-up except for anxiety symptoms (Quality of life: $F = 9.04$, $p < .001$; Depressive symptoms: $F = 6.72$, $p = .002$; Alcohol dependence severity: $F = 34.32$, $p < .001$; Alcohol-related problems: $F = 16.18$, $p < .001$). Drinking groups did not significantly differ on functional outcomes at 4-month follow-up (days of work, days with interpersonal conflicts, income), with the exception of legal problems ($F = 3.61$, $p = .030$).

To interpret group differences, we conducted post-hoc Tukey HSD tests on the marginal predicted values for each outcome. These results are presented in detail in Tables 4 (4-month follow-up) and 5 (12-month follow-up). As compared to those in the reduced and non-reduced groups, the abstinent group had significantly higher quality of life, and fewer alcohol-related problems. The abstinent group reported significantly fewer depressive symptoms than the reduced group. The non-reduced group reported significantly higher alcohol dependence severity than the abstinent and reduced groups, who were not statistically different from one another. Lastly, at 4-month follow-up, the non-reduced group's predicted value for legal problems was significantly higher than the reduced group's.

There was one interaction between baseline severity and group membership in predicting legal problems at the 4-month follow-up ($F = 7.35$, $p = .001$; see Figure 2). Simple slopes between group membership and legal problems were probed at low and high levels of baseline severity. These tests showed that those with low baseline severity had significantly fewer legal problems when they were in the reduced group as compared to being abstinent ($B = -1.02$, $p = .015$) and significantly more legal problems when they were in the non-reduced group as compared to being abstinent ($B = 1.35$, $p = .025$).

Outcomes at 12-month Follow-up

Drinking groups (abstinent, reduced, or non-reduced) were significantly different from one another on all psychological outcomes at 12-month follow-up except for anxiety symptoms (Quality of life: $F = 9.64$, $p < .001$; Depressive symptoms: $F = 7.62$, $p < .001$; Alcohol dependence severity: $F = 29.76$, $p < .001$; Alcohol-related problems: $F = 22.58$, $p < .001$). Drinking groups also significantly differed in days of work ($F = 4.05$, $p = .020$) and interpersonal conflicts ($F = 5.00$, $p = .009$) at 12-month follow-up, but not legal problems or income.

To interpret group differences, post-hoc Tukey HSD contrasts are displayed in Table 5. The abstinent group reported significantly higher quality of life than the other two groups, significantly fewer depressive symptoms than the non-reduced group, and reported significantly more days of work and fewer interpersonal conflicts as compared to the reduced drinking group. As compared to those in the abstinent and reduced groups, who were not statistically different, the non-reduced group had significantly higher alcohol dependence severity and alcohol-related problems.

DISCUSSION

The present study extends the literature by examining the prevalence and maintenance of drinking reductions following inpatient treatment and their effects on psychological and functional outcomes among alcohol use disorder (AUD) inpatients with comorbid anxiety and depression. Our results showed that most patients who reduced their drinking were abstinent, and around 25% continued drinking at a reduced rate at the follow-up appointments. The relatively low rates of reduced drinking and high rates of abstinence may have resulted, in part, from the abstinence-only focus of the inpatient treatment program where patients were enrolled, where any drinking is viewed as a treatment failure.

Roughly 25% of the sample reported reductions by 1 to 3 WHO risk levels without abstinence. Many of these individuals reported abstinence at other time points, particularly immediately after treatment. In contrast, for those who reported drinking the same as their baseline level of drinking one month after treatment, very few of them moved into abstinent or reduced drinking categories at future time points. Among those who drank at a reduced level in the first month after treatment, maintenance of reduced drinking levels at 12-month follow-up were fairly high (63% for 3-level reductions, 80% for 1-level reductions). Importantly, maintenance rates did not vary by baseline severity, consistent with prior research on inpatients (Orford & Keddie, 1986) and outpatients (Henssler et al., 2021; Witkiewitz et al., 2020). However, it is noteworthy that there were very few mild cases in the current study, hampering our ability to observe the difference between mild and moderate or severe cases.

We found that generally, patients who reported abstinence at 4-month follow-up reported significantly better quality of life, depressive symptoms, and alcohol-related problems as compared to reducers. The effect size of these differences was generally in the medium-large range. The abstinent and reduced groups were not statistically different on most outcomes (alcohol dependence severity, anxiety symptoms, days of work, interpersonal conflicts, legal

problems, and income). There was high variability in outcomes (see SDs in Table 3), potentially leading to difficulty detecting significant group differences. There were generally fewer group differences on functional outcomes like employment and legal problems, suggesting these outcomes would be better predicted by factors other than alcohol use after treatment. The reduced drinking group was not significantly different from the non-reduced group in almost all outcomes, but they did report significantly lower alcohol dependence severity and fewer legal problems.

At the 12-month follow-up, the abstinent and reduced groups were again not significantly different on most outcomes, including alcohol dependence severity and alcohol-related problems. Given high baseline values for both of these variables throughout the sample, this finding means that those who reduced their alcohol consumption experienced improvements in alcohol-related variables on par with those who reported abstinence, consistent with some prior research (Collins et al., 2019; Henssler et al., 2021). However, the abstinent group did report continued higher quality of life (consistent with 4-month follow-up) and significantly more days of work and fewer interpersonal conflicts then the reduced drinking group at 12-month follow-up, suggesting that abstinence confers additional benefit in these areas. Lastly, although the reduced group did report improvements in alcohol-related variables, it is also noteworthy that the reduced group was not statistically different from the non-reduced group on all other outcomes at 12-month follow-up.

Overall, those who reduced their WHO drinking risk level experienced improvements in alcohol-related outcomes but were not significantly different from those who didn't reduce their drinking in terms of other psychological or functional outcomes. Though there is little prior work comparing the same psychological and functional outcomes examined in this work in abstainers versus reducers, results are generally consistent with previous studies showing that reducing alcohol consumption does confer some benefits (Knox et al., 2019; Witkiewitz et al., 2017; Witkiewitz et al., 2020), but other benefits (e.g., reductions in mortality, improvements in health) are greater when patients fully abstain from alcohol (Roerecke et al., 2013).

We also examined the impact of baseline alcohol dependence severity (mild and moderate versus severe) on outcomes and its interaction with reduction status in predicting outcomes. Baseline severity interacted with group to predict legal problems at 4-month follow-up, but the differences did not reveal a clear pattern of the disproportionate benefit of either abstinence or reductions depending on severity. That is, interactions did not support the idea that reducing one's drinking risk level is any more or less effective (in impacting psychological and functional outcomes studied here) for severe cases compared to moderate cases. This result is consistent with previous research on outpatients (Henssler et al., 2021). It extends those findings to an inpatient population, although with a restricted range in baseline severity (i.e., very few mild cases).

Limitations

The present work includes limitations to be considered when interpreting the results. First, participant drop-out was significant (~30% for 4-month and 12-month follow-ups). Although demographics and baseline severity measures were not related to the likelihood

of completing follow-up appointments (except education), it is likely that missing data are not randomly distributed across outcomes of interest. However, analyses with missing data imputed found no difference in results.

It is also important to note that our participants were enrolled in an abstinence-focused inpatient treatment program. In this program, there is no programming to support patients in moderating their drinking, and there is shame/stigma surrounding drinking after treatment. Hence, it is likely that subjects felt that reduced drinking was not a supported treatment goal and may have resulted in over-reporting of abstinence. Relatedly, because we do not know the subjects' goals for their alcohol use, it is possible that some of those who reported reduced drinking had been attempting to abstain. In this context, reduced drinking would be experienced as a failure instead of progress, which may reduce any beneficial effects of reduced drinking.

It is also possible that alcohol use was not accurately recalled due to a retrospective report of alcohol consumption, particularly the report of the first month of drinking taking place at 4-month follow-up. Lastly, WHO risk levels were calculated using average daily consumption, which does not characterize the *pattern* of drinking. Prior studies have found that moderate drinking days protect against alcohol-related problems (Witkiewitz, 2013) and high healthcare costs (Aldridge et al., 2016), regardless of overall consumption.

Conclusion

The current study found that most inpatients with alcohol dependence and comorbid anxiety disorder abstained after treatment, and around 25% reduced their drinking by one to three WHO drinking risk levels (without abstinence). These reductions were maintained reasonably well at the 12-month follow-up (74%), and this did not vary by baseline severity. At the 4- and 12-month follow-ups, abstinence was predictive of the largest and broadest improvements in psychological and functional outcomes. However, reducers also reported significantly improved alcohol dependence severity and alcohol-related problems compared to those who did not reduce their drinking. Baseline severity did not uniformly impact improvements, indicating that moderate and severe cases benefited roughly equally from reductions in WHO drinking risk level. Based on our findings, and notwithstanding the limitations noted, this work suggests that while abstinence is associated with the greatest psychological and functional improvements for inpatients attending an abstinence-focused treatment program, those who reduce their drinking also report significant improvements in alcohol-related outcomes as compared to those who return to drinking at their baseline level.

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Public Significance:

The results of this study indicate that reducing one's drinking by one to three WHO risk levels following inpatient treatment is associated with beneficial alcohol-related outcomes (e.g., fewer alcohol-related problems) at one year post-treatment. However, abstinence was associated with larger improvement in psychological outcomes than reducing drinking, as well as some functional outcomes (e.g., more days of work, fewer interpersonal problems).

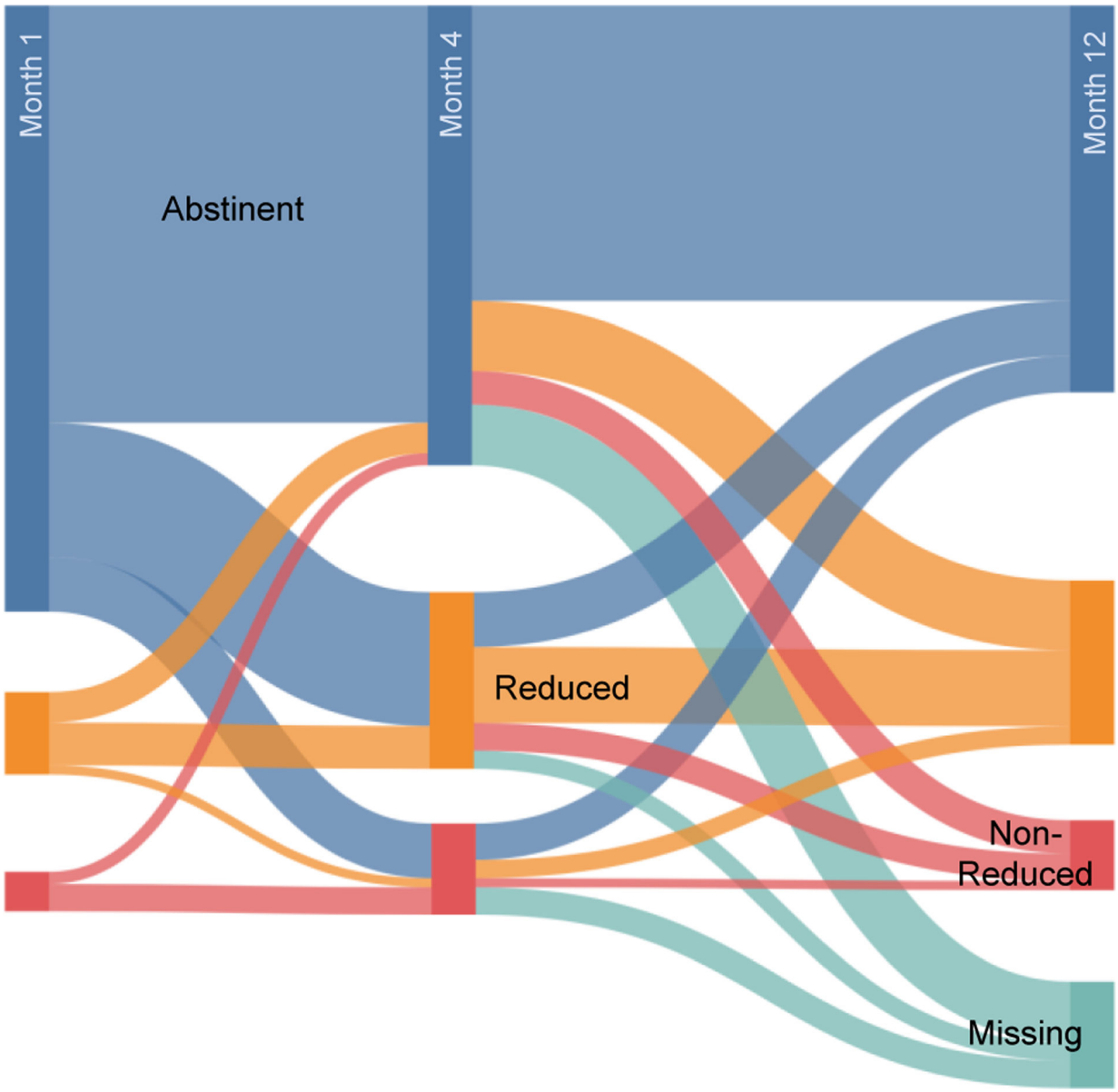

Figure 1.
Flow of participants between drinking groups at all follow-up time points. Graphic made using SankeyMATIC.com.

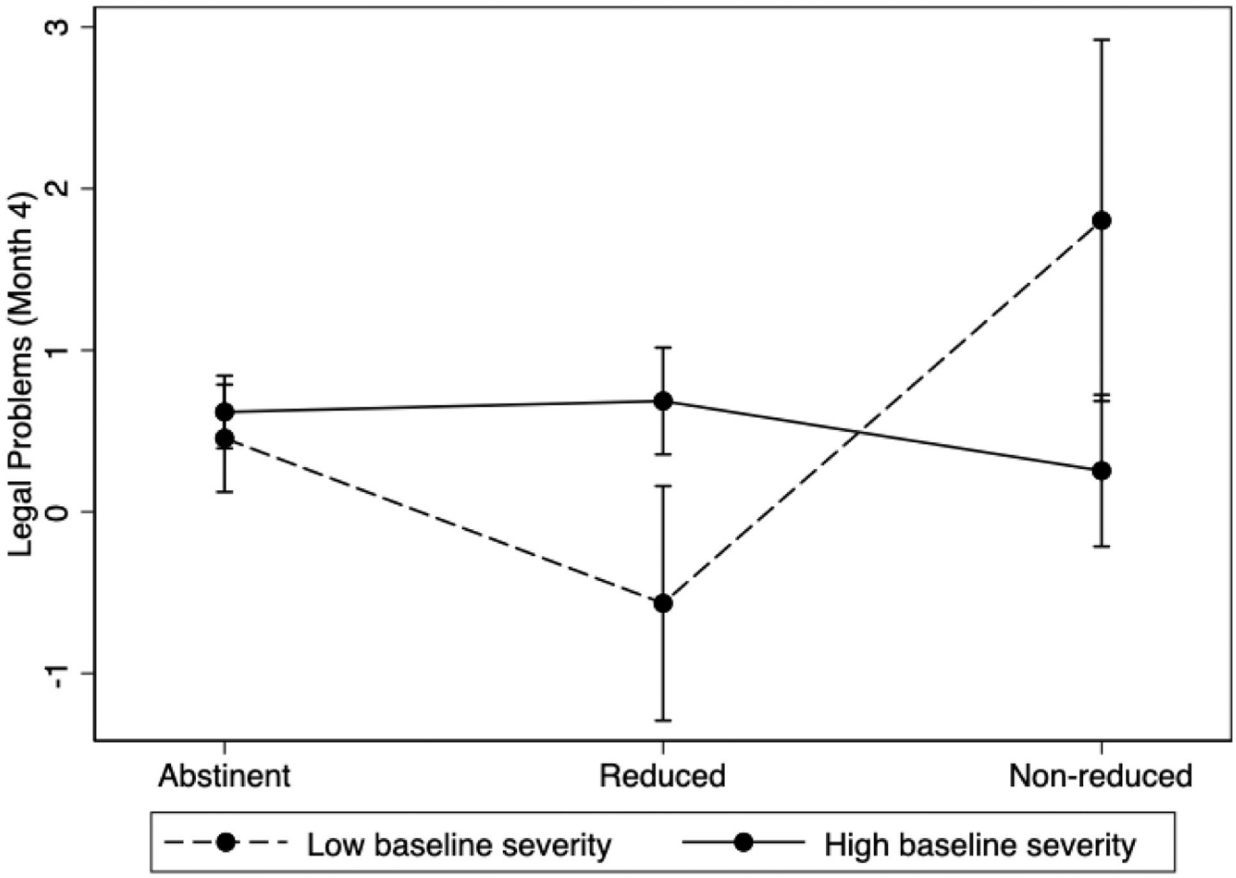

Figure 2.
Legal Problems by Drinking Group and Baseline Severity (Month 4). Bars are 95% confidence intervals.

Table 1

Baseline demographics of sample

	Sample returned for follow-up (N = 241)	Sample did not return for follow-up (N = 86)	Difference test
Age	*M* = 39.9 *SD* = 10.4	*M* = 38.3 *SD* = 8.9	*p* = .234
Sex	**N (%)**	**N (%)**	*p* = .282
Female	100 (41.5)	30 (34.9)	
Race			*p* = .600
White	181 (75.1)	58 (67.4)	
Black	26 (10.8)	7 (8.1)	
Am. Indian/Alaska Native	19 (7.9)	3 (3.5)	
Hispanic	4 (1.7)	0 (0.0)	
Asian/Pac. Islander	2 (0.8)	1 (1.2)	
Other	3 (1.2)	0 (0.0)	
Missing/declined	6 (2.5)	17 (19.8)	
Education			*p* < .001
Some high school	13 (5.4)	12 (14.0)	
High school graduate	40 (16.6)	10 (11.6)	
Some college	85 (35.3)	23 (26.7)	
Associate's degree	43 (17.8)	9 (10.5)	
Bachelor's degree	30 (12.5)	9 (10.5)	
Some graduate school	10 (4.2)	2 (2.3)	
Graduate degree	14 (5.8)	5 (5.8)	
Missing/declined	5 (2.1)	16 (18.6)	
WHO Levels			*p* = .240
Abstinent	3 (1.2)	0 (0.0)	
Low risk	16 (6.6)	5 (5.8)	
Medium risk	21 (8.7)	2 (2.3)	
High risk	29 (12.0)	10 (11.6)	
Very high risk	172 (71.4)	69 (80.2)	
Number of diagnoses			*p* = .406
1	76 (31.5)	26 (30.2)	
2	83 (34.4)	31 (36.1)	
3	64 (26.6)	18 (20.9)	
4	18 (7.5)	11 (12.8)	

Note. Sex was dichotomously categorized in this study as male or female. Diagnoses included in the baseline diagnosis variable were panic disorder, social anxiety disorder, generalized anxiety disorder, and major depressive disorder. Follow-up is 4-month follow-up.

Table 2

WHO Risk Levels and Abstinence Rates

	1-month post-treatment (N = 239)	4 months post-treatment (N = 241)	12 months post-treatment (N = 222)
Drinking Group	**N (%)**	**N (%)**	**N (%)**
Abstinent	199 (83.3)	151 (62.7)	134 (60.4)
Reduced	27 (11.3)	60 (24.9)	59 (26.6)
Non-reduced	13 (5.4)	30 (12.5)	29 (13.1)
WHO Levels			
Abstinent	199 (83.3)	151 (62.7)	134 (60.4)
Low risk	23 (9.6)	50 (20.7)	44 (19.8)
Medium risk	6 (2.5)	10 (4.1)	13 (5.9)
High risk	2 (0.8)	12 (5.0)	7 (3.2)
Very high risk	9 (3.8)	18 (7.5)	24 (10.8)
WHO Level Reductions (Excluding abstainers)	**1-month post-treatment (N = 40)**	**4 months post-treatment (N = 90)**	**12 months post-treatment (N = 88)**
Increased	3 (7.5)	3 (2.2)	4 (3.4)
Same level	10 (25)	28 (31.1)	26 (29.6)
1-level reduction	3 (7.5)	14 (15.6)	14 (15.9)
2-level reduction	7 (17.5)	12 (13.3)	17 (19.3)
3-level reduction	17 (42.5)	34 (37.8)	28 (31.8)

Note. Levels were calculated as average daily consumption in the preceding 30-day period. All WHO level reductions were calculated using the month prior to treatment (baseline) as the reference period. Though both 1-month and 4-month alcohol use were measured at the same time, 2 people reported that they were “unavailable” during the first month after treatment (e.g., incarcerated or in inpatient treatment) so they do not have drinking data to include in the first month after treatment.

Table 3

Means and Standard Deviations of Outcomes

	Abstinent *M*(*SD*)		**Reduced *M*(*SD*)**		**Non-reduced *M*(*SD*)**	
Outcome	Month 4 *N* = 151	Month 12 *N* = 134	Month 4 *N* = 60	Month 12 *N* = 59	Month 4 *N* = 30	Month 12 *N* = 29
Quality of Life	2.87 (0.78)	2.80 (0.84)	2.27 (0.80)	2.28 (0.78)	1.96 (0.80)	1.79 (0.85)
Depressive Symptoms	9.84 (7.79)	10.04 (9.99)	15.63 (9.32)	13.24 (9.83)	15.13 (7.92)	20.45 (10.98)
Alcohol Dependence Severity	0.02 (0.27)	0.05 (0.36)	0.41 (0.83)	0.65 (1.07)	1.86 (1.35)	1.88 (1.32)
Alcohol-related problems	0.08 (0.85)	1.11 (9.08)	3.69 (6.24)	3.38 (6.09)	9.66 (9.65)	15.17 (11.88)
Anxiety Symptoms	40.43 (12.18)	33.67 (9.00)	46.73 (11.33)	38.05 (10.90)	48.80 (11.47)	36.00 (10.48)
Days of work	10.84 (10.99)	12.26 (11.33)	7.65 (10.04)	8.06 (10.86)	3.72 (7.14)	3.76 (7.34)
Interpersonal conflicts	1.45 (4.77)	1.07 (4.28)	4.63 (10.16)	3.15 (6.93)	3.63 (5.33)	6.37 (9.44)
Legal problems	0.34 (0.89)	0.25 (0.74)	0.62 (0.99)	0.62 (1.14)	0.70 (1.24)	0.36 (0.73)
Income	1086.97 (2027.19)	1515.91 (4247.40)	610.06 (954.98)	671.98 (1535.96)	1087.31 (4432.68)	109.45 (302.71)

Note. Alcohol dependence severity was coded as 0 = no dependence, 1 = mild, 2 = moderate, 3 = severe.

Table 4

Group Differences at 4-Month Follow-Up

Outcome	Contrast	Std. Error	P value	95% Confidence Interval	
Quality of Life					
Abstinent vs. Reduced	−0.71	0.21	.002	−1.20	−0.22
Abstinent vs. Non-reduced	−0.87	0.29	.009	−1.56	−0.18
Reduced vs. Non-reduced	−0.16	0.33	.885	−0.94	0.63
Depressive Symptoms					
Abstinent vs. Reduced	6.99	2.08	.003	2.06	11.92
Abstinent vs. Non-reduced	5.82	2.95	.123	−1.17	12.81
Reduced vs. Non-reduced	−1.17	3.33	.935	−9.06	6.73
Alcohol Dependence Severity					
Abstinent vs. Reduced	0.10	0.19	.851	−0.36	0.57
Abstinent vs. Non-reduced	2.26	0.27	<.001	1.61	2.91
Reduced vs. Non-reduced	2.16	0.32	<.001	1.40	2.92
Alcohol-related problems					
Abstinent vs. Reduced	3.80	1.17	.004	1.02	6.57
Abstinent vs. Non-reduced	8.15	1.61	<.001	4.33	11.98
Reduced vs. Non-reduced	4.36	1.86	.054	−0.06	8.78
Legal problems					
Abstinent vs. Reduced	−0.48	0.24	.125	−1.05	0.10
Abstinent vs. Non-reduced	0.49	0.32	.284	−0.28	1.26
Reduced vs. Non-reduced	0.97	0.37	.029	0.08	1.86
Anxiety Symptoms	No significant group differences				
Days of work					
Interpersonal conflicts					
Income					

Note. Contrasts indicate the model-predicted difference in the outcome when subtracting the latter group's value from the former (e.g., quality of life is predicted to be .71 points lower in the reduced drinking group compared to the abstinent group).

Table 5

Group Differences at 12-Month Follow-Up

Outcome	Contrast	Std. Error	P value	95% Confidence Interval	
Quality of Life					
Abstinent vs. Reduced	−0.52	0.21	.038	−1.01	−0.02
Abstinent vs. Non-reduced	−1.13	0.28	<.001	−1.80	−0.46
Reduced vs. Non-reduced	−0.61	0.32	.138	−1.37	0.15
Depressive Symptoms					
Abstinent vs. Reduced	4.87	2.51	.132	−1.09	10.83
Abstinent vs. Non-reduced	11.59	3.16	.001	4.07	19.10
Reduced vs. Non-reduced	6.71	3.70	.170	−2.07	15.50
Alcohol Dependence Severity					
Abstinent vs. Reduced	0.41	0.18	.067	−0.02	0.85
Abstinent vs. Non-reduced	1.95	0.26	<.001	1.34	2.56
Reduced vs. Non-reduced	1.53	0.29	<.001	0.84	2.23
Alcohol-related problems					
Abstinent vs. Reduced	1.60	1.38	.477	−1.67	4.87
Abstinent vs. Non-reduced	12.79	1.90	<.001	8.26	17.31
Reduced vs. Non-reduced	11.18	2.17	<.001	6.02	16.35
Days of work					
Abstinent vs. Reduced	−8.07	2.88	.016	−14.91	−1.23
Abstinent vs. Non-reduced	−3.62	3.51	.559	−11.97	4.72
Reduced vs. Non-reduced	4.45	4.08	.552	−5.24	14.14
Interpersonal conflicts					
Abstinent vs. Reduced	3.70	1.43	.030	0.30	7.10
Abstinent vs. Non-reduced	3.88	1.73	.068	−0.23	7.99
Reduced vs. Non-reduced	0.18	2.04	.996	−4.67	5.03
Anxiety Symptoms	No significant group differences				
Legal problems					
Income					

Note. Contrasts indicate the model-predicted difference in the outcome when subtracting the latter group's value from the former (e.g., quality of life is predicted to be .52 points lower in the reduced drinking group compared to the abstinent group).