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Physical Health and Drinking among Medical Inpatients with Unhealthy Alcohol Use: A Prospective Study

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Abstract

Objective—Unhealthy alcohol use is common in medical inpatients, and hospitalization has been hypothesized to serve as a "teachable moment" that could motivate patients to decrease drinking, but studies of hospital-based brief interventions have often not found decreases. Evaluating associations between physical health and subsequent drinking among medical inpatients with unhealthy alcohol use could inform refinement of hospital-based brief interventions by identifying an important foundation on which to build them. We tested associations between poor physical health and drinking after hospitalization and whether associations varied by alcohol dependence status and readiness to change.

Methods—Participants were medical inpatients who screened positive for unhealthy alcohol use and consented to participate in a randomized trial of brief intervention (n=341). Five measures of physical health were independent variables. Outcomes were abstinence and the number of heavy drinking days (HDDs) reported in the 30 days prior to interviews 3 months after hospitalization. Separate regression models were fit to evaluate each independent variable controlling for age, gender, randomization group, and baseline alcohol use. Interactions between each independent variable and alcohol dependence and readiness to change were tested. Stratified models were fit when significant interactions were identified.

Results—Among all participants, measures of physical health were not significantly associated with either abstinence or number of HDDs at 3 months. Having an alcohol-attributable principal

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admitting diagnosis was significantly associated with fewer HDDs in patients who were non-dependent [adjusted incidence rate ratio (aIRR) 0.10, 95% CI 0.03 – 0.32] or who had low alcohol problem perception (aIRR 0.36, 95% CI 0.13 – 0.99) at hospital admission. No significant association between alcohol-attributable principal admitting diagnosis and number of HDDs was identified for participants with alcohol dependence or high problem perception.

Conclusions—Among medical inpatients with non-dependent unhealthy alcohol use and those who do not view their drinking as problematic, alcohol-attributable illness may catalyze decreased drinking. Brief interventions that highlight alcohol-related illness might be more successful.

INTRODUCTION

Medical illness and poor physical health status are common among patients with unhealthy alcohol use (Blow et al., 2000; Bridevaux et al., 2004; Chou et al., 1996; Green et al., 2004; Rehm et al., 2003; Room et al., 2005; Saitz et al., 2006; Solberg et al., 2008; Stein, 1999; Williams et al., In press), a term which is used to describe a spectrum from drinking amounts that risk health consequences (e.g. above recommended limits), to drinking amounts associated with consequences but not yet meeting criteria for a disorder, to meeting diagnostic criteria for alcohol abuse or dependence (Saitz, 2005). Approximately 25% of all persons admitted to general hospitals have alcohol use disorders or are being treated for the consequences of their drinking, making hospitalization a potentially opportune time for interventions to reduce unhealthy alcohol use (Smothers et al., 2003). However, the evidence in support of brief counseling interventions in hospital settings is mixed, often showing lack of efficacy (Chick et al., 1985; Elvy et al., 1988; Emmen et al., 2004; Freyer-Adam et al., 2008; Heather et al., 1996; Holloway et al., 2007; Persson J and Magnusson P, 1989; Saitz et al., 2009; Saitz et al., 2007). This lack of efficacy may be due in part to the high prevalence of dependence among patients with unhealthy alcohol use in hospitals (Saitz et al., 2006), although studies that excluded dependent patients have also had mixed results (McQueen et al., 2009). Improvements in opportunistic counseling interventions for hospitalized patients identified with unhealthy use, including dependence, are sorely needed.

Qualitative studies have identified factors responsible for catalyzing change in patients with unhealthy alcohol use (Orford and Hawker, 1974; Orford et al., 2006; Orford et al., 2008), which include “awareness of accumulating harms” and “triggering occurrences”(Orford et al., 2006). As such, poor physical health may serve as a catalyst of change. Further, in the context of a hospitalization, which has been hypothesized to provide a “teachable moment,” patients with unhealthy alcohol use may recognize the link between their drinking and health and be particularly amenable to making changes in their drinking (Figlie et al., 2005; Stewart and Connors, 2007), with or without intervention. As such, patients with the physical health consequences from alcohol use would be more likely to change than those without such consequences.

Factors that may catalyze change among patients with unhealthy alcohol use may operate differently for patients based on both the severity of dependence symptoms and their readiness for or commitment to change. Specifically, patients with alcohol dependence, who typically exhibit impaired control over their drinking, or those who are not ready to change may be less likely to decrease drinking after a catalyst than those without dependence or those with greater readiness to change (DiMartini et al., 2002; Kelly et al., 2006; Moos and Moos, 2006; Orford et al., 2008; Saitz et al., 2009; Vielva and Iraurgi, 2001; Walton et al., 2003).

Evaluating associations between physical health and subsequent drinking among medical inpatients with unhealthy alcohol use could help to inform further refinement of hospital-based brief interventions by identifying whether they should specifically focus on physical

health. This study sought, in a secondary analysis of data collected prospectively, to evaluate whether, independent of an intervention, 5 different measures of physical health were associated with two drinking outcomes 3 months after hospitalization and to explore whether associations between physical health and drinking vary by alcohol dependence or readiness to change.

METHODS

Study Design

We studied a prospective cohort of adult medical inpatients with unhealthy alcohol use who were first identified by screening in the hospital and then enrolled in a randomized trial of brief alcohol counseling. Although the intervention was not associated with decreased drinking or receipt of alcohol-related treatment in this trial (Saitz et al., 2007), some subgroups, including patients without alcohol dependence, appeared to benefit from the brief intervention (Saitz et al., 2009). The study represents a secondary analysis of data collected during this trial and was approved by the institutional review boards of Boston Medical Center and the University of Washington. Subjects provided informed consent to participate in the trial and were compensated for each completed interview. A Federal government Certificate of Confidentiality was obtained to protect participant privacy.

Participants

Participants included 341 adult medical inpatients who reported drinking risky amounts in the past month defined as >14 standard drinks per week or ≥5 drinks per occasion for men (>11 and ≥4, respectively, for both women and people ≥66 years (i.e., screened positive for unhealthy alcohol use) based on the screening strategy recommended by the National Institute on Alcohol Abuse and Alcoholism (National Institute on Alcohol Abuse and Alcoholism et al., 2007). Participants also were fluent in English or Spanish, provided names of 2 contacts to assist with follow-up, had no plans to move away from the study area in the following year, scored 21 or more points on the Mini-Mental State Examination (Smith et al., 2006), and consented to participate in the trial (Saitz et al., 2007).

Assessments

Participants were assessed via in-person interviews by trained research associates at enrollment and a 3-month follow-up visit. Also at enrollment, a physician-researcher reviewed each participant's medical record to determine medical diagnoses, including the principal reason for admission (principal admitting diagnosis).

Measures

Drinking Outcomes—Alcohol use in the 30 days before each interview was assessed using the validated Timeline Follow-Back calendar method (Sobell et al., 1988), which identifies the number of standard drinks consumed on each of the past 30 days. Two drinking measures derived from the Timeline Follow-Back were used as study outcomes: 1) 30-day abstinence and 2) number of heavy drinking days (HDDs) reported in the 30 days prior to the 3-month assessment. HDDs were defined as drinking ≥5 drinks per day for men and ≥4 per day for women.

Independent Variables—Five measures of different dimensions of physical health, the independent variables for the study, were derived from interview and structured record review at the time of enrollment: 1) recent medical comorbidity, 2) lifetime medical comorbidity, 3) self-reported physical health status, 4) any alcohol-attributable medical diagnosis, and 5) alcohol-attributable principal admitting diagnosis. Medical comorbidities

were assessed using a questionnaire validated by Katz, et al., which is similar to the Charlson Comorbidity Index (Charlson et al., 1994) but is based on patient report instead of administrative data and assesses the presence of medical illnesses including kidney disease, diabetes, heart disease, chronic obstructive pulmonary disease, AIDS, and others using both recent (past 3 months) and lifetime timeframes (Katz et al., 1996). We categorized the number of recent and lifetime comorbidities (0, 1, or ≥ 2). The physical component summary (PCS) score from the 12-item Short Form Health Survey (Ware et al., 1996) measured physical health status. The PCS score ranges from 1–100 and is standardized to the U.S. population mean with 1 representing poor and 100 representing perfect physical health status (Ware et al., 1996). To avoid an assumption of linearity, PCS scores were categorized into quintiles with the highest quintile (best health) used as the referent category. Finally, a physician-researcher reviewed each patient's medical record at enrollment for any medical diagnoses that are 100% alcohol-attributable, and for whether any of these were the principal admitting diagnosis. Diagnoses included alcohol intoxication, alcoholic pellagra, alcoholic polyneuropathy, alcoholic gastritis, alcohol cardiomyopathy, alcoholic liver damage, acute alcoholic cirrhosis of the liver, alcoholic hepatitis, alcoholic fatty liver, alcoholic amnestic syndrome, other alcoholic dementia, alcohol withdrawal, alcohol withdrawal hallucinosis, alcohol withdrawal delirium, other alcoholic psychosis, alcohol withdrawal convulsion, or alcoholic pancreatitis (Adams et al., 1993).

Potential Effect Modifiers—DSM IV diagnosis of current alcohol dependence (American Psychiatric Association, 1994) was made at enrollment based on the Composite International Diagnostic Interview (CIDI) Alcohol Module (Robins et al., 1988). Readiness to change drinking was assessed via interview with the validated Stages of Change Readiness and Treatment Eagerness Scale (SOCRATES), which was developed to assess readiness among individuals presenting for specialty alcohol treatment (Miller and Tonigan, 1996). Two SOCRATES components (*Problem Perception* and *Taking Action*) were used rather than the 3 factors originally described based on results from a previous factor analysis in this patient population (Bertholet et al., 2009b), because it is consistent with another prior study (Maisto et al., 1999) and because these factors more aptly describe change readiness among patients not actively seeking or receiving specialty alcohol treatment. The two components yield continuous scores (range: 10–50 for Problem Perception, 6–30 for Taking Action) with higher scores representing more readiness. The readiness scores have been previously modeled using quartiles of the distribution due to non-linear associations with drinking outcomes (Bertholet et al., 2009b). For this study, each score was dichotomized based on the observed associations with the outcomes of interest for this study and for ease of interpretation. Based on results of preliminary analyses categorizing readiness scores using quartiles of the distribution, Problem Perception was dichotomized at the 50^{th} and Taking Action at the 75^{th} percentile; residual plots and likelihood ratio tests evaluating goodness-of-fit suggested adequate fit.

Covariates—Covariates representing potential confounders were selected based on known associations between medical illness or health status and alcohol use and included: demographic characteristics (age in years, female gender, and race including Hispanic, Black, White, and other); smoking status [never, current, and past (Fagerstrom Tolerance Test), and quantity/frequency questions] (Pomerleau et al., 1994), and alcohol use reported at enrollment. Number of drinks per day (continuous variable) was included in models with abstinence as the outcome, and the number of heavy drinking days in the 30 days prior to baseline (categories: 0–1, 2–14, and ≥ 15 heavy drinking days) was included in models with number of heavy drinking days as the outcome. For evaluating the association between measures of physical health and abstinence, alcohol dependence was considered a potential

confounder (in addition to a potential effect modifier) due to its strong associations with both medical illness and abstinence (Dawson et al., 2005). Despite the negative main trial results, randomization group was also included as a covariate because we sought to identify associations independent of intervention, subgroup analyses suggested some intervention effect, and the intervention may have resulted in differences in drinking or readiness to change between groups (Saitz et al., 2009).

Analyses

Subjects lost to follow-up were compared with those assessed at 3 months on all patient demographic and drinking characteristics using chi-square statistics, two-sample t-tests, and non-parametric (two-sample Wilcoxon rank-sum or Mann-Whitney) tests as appropriate. Separate logistic regression models were fit to evaluate the association between each of the 5 independent variables and 30-day abstinence. Negative binomial regression was used to model the association between each of the independent variables and the number of heavy drinking days reported at 3 months, because days are counts with a skewed distribution (large numbers of zeros from abstinent subjects, and some extreme numbers of days). Negative binomial regression generates estimates of the incidence rate ratio (IRR), which is interpreted as a multiplicative increase or decrease in the number of days for each 1-unit difference in the predictor variable (similar to a relative risk). A robust variance correction was used to allow for over-dispersion. Preliminary unadjusted models were fit first and then adjusted models controlling for all covariates were used as the primary analysis. Multiplicative first-order interactions between each measure of physical health and potential effect modifiers (dependence status and readiness to change) were tested in both unadjusted and adjusted models. Stratified analyses were conducted when interactions were significant ($p<0.05$). We did not formally adjust for multiple comparisons because this secondary analysis was exploratory and intended to assess whether a single concept—physical health—was associated with drinking 3 months after hospitalization. All analyses were performed using Stata Version 10.1 (StataCorp., 2007).

RESULTS

Participants had a mean age of 44 years and were racially diverse (45% Black, 39% White, and 9% Hispanic) (Table 1). Only 14% of participants reported never smoking; 75% reported current smoking. At baseline, patients reported consuming a median of 3.6 drinks per day, 38% of patients reported 15 or more heavy drinking days, 4% met diagnostic criteria for current alcohol abuse, and 77% met criteria for current alcohol dependence. Patients generally reported high levels of recognition of unhealthy drinking and efforts to change. Mean problem perception score was 35 (SD 11, range 10–50), and mean Taking Action score was 21 (SD 6, range 6–30). Participants had poor average physical health status [Physical Component Summary score of 38 (SD 9)]; 22% reported 2 or more recent medical comorbidities, and 33% reported 2 or more lifetime comorbidities. Forty-six percent of participants had any alcohol-attributable medical diagnosis in their medical record, while 15% had an alcohol-attributable principal admitting diagnosis.

Overall, 272 patients were interviewed 3 months after hospitalization (80% follow-up). No statistically significant differences (at $p<0.05$) in demographic or drinking characteristics were identified between those with and without follow-up. However, a non-significantly greater proportion of patients with follow-up, compared to those without, met diagnostic criteria for alcohol dependence (79% vs. 68%, $p=0.06$). There were no significant differences in measures of physical health between those who did and did not complete follow-up.

At 3 months, 60 participants (22% of those with follow-up) were abstinent, and the median number of heavy drinking days was 5 (range 0 to 30). Most measures of physical health were not significantly associated with either abstinence or the number of heavy drinking days reported at 3 months in both unadjusted and adjusted regression models (Table 2). However, in unadjusted models, patients in the lowest quintile of self-reported physical health status (worst health) had significantly greater odds of abstinence at 3 months compared to those in the highest quintile (OR 3.35, 95% CI 1.25 – 8.96). The significance of the association was attenuated after adjustment (Table 2).

P-values for all tests of effect modification are presented in Table 3. Alcohol dependence significantly modified the association between having any alcohol-attributable medical diagnosis and abstinence and between having an alcohol-attributable principal admitting diagnosis and the number of heavy drinking days reported at 3 months but did not modify any other associations between measures of physical health and either drinking outcome. For the 58 participants without alcohol dependence, having an alcohol-attributable medical diagnosis (n=13) was significantly associated with increased abstinence in unadjusted analyses (OR 4.36; 95% CI: 1.12 – 17.0)3 but not after adjustment for potential confounders (OR 3.83; 95% CI 0.75 – 19.59). For those who were alcohol dependent (n=214), there was no significant association between having an alcohol-attributable diagnosis (n=114) and abstinence in unadjusted or adjusted analyses (ORs 0.90; 95% CI 0.47 – 1.70 and 0.78; 95% CI 0.41 – 1.62, respectively). For the 58 participants who were not alcohol dependent, having an alcohol-attributable principal admitting diagnosis (n=4) was significantly associated with fewer heavy drinking days in unadjusted and adjusted models (Table 4). For the 214 participants who were alcohol dependent, there was no significant association between having an alcohol-attributable principal admitting diagnosis (n=37) and number of heavy drinking days (Table 4).

Neither measure of readiness to change modified any of the associations between measures of physical health and abstinence in unadjusted or adjusted analyses (Table 3). In contrast, both measures of readiness to change modified associations between having an alcohol-attributable principal admitting diagnosis and the number of heavy drinking days at 3 months (Table 3). Associations in unadjusted and adjusted analyses stratified by levels of Taking Action were not significant. However, among subjects with low Problem Perception (n=132), those with an alcohol-attributable principal admitting diagnosis (n=9) had 0.36 times the number of heavy drinking days compared to those without such a diagnosis (95% CI 0.13 – 0.99) (Table 4). No association was detected between having an alcohol-attributable principal admitting diagnosis (n=30) and heavy drinking days among participants with high Problem Perception (n=137). Problem Perception also modified the association between self-reported physical health status and heavy drinking days (Table 3). Among the 132 patients with low Problem Perception, those in the 2^{nd} Quintile of health status (n=20) had 2.06 times the number of heavy drinking days (95% CI 1.17 – 3.62) compared to those in the referent group with the highest health status [5^{th} Quintile (n=33)] in unadjusted analyses. However, associations in stratified adjusted analyses were all not significant. No other significant interactions were found between readiness to change and the independent variables in models of heavy drinking days at 3 months (Table 3).

DISCUSSION

In this study of medical inpatients with unhealthy alcohol use, most participants had alcohol dependence and reported substantial medical comorbidity. Among all participants, there were no significant associations between measures of physical health and either abstinence or heavy drinking days 3 months after hospitalization, though we did observe a borderline-significant association between worse physical health status and abstinence. However,

among participants with non-dependent unhealthy alcohol use and those who were less aware of their drinking as a problem regardless of dependence status, having an alcohol-attributable principal admitting diagnosis was associated with less heavy episodic drinking at follow up.

Several previous studies have explored the idea that medical illness or one's perception of their physical health may be associated with or lead to changes in drinking. Multiple successful alcohol-related interventions have focused on addressing a medical issue via ongoing monitoring of abnormal alcohol-related lab tests or blood pressure (Fleming et al., 2004; Kristenson et al., 1983; Kristenson et al., 2002; Maheswaran R et al., 1992; Willenbring and Olson, 1999). One study of patients with HIV and past alcohol problems found that those who were told they had hepatitis C were more likely to reduce drinking at follow-up than those who were not (Tsui et al., 2007), and interventions in patients identified as heavy drinkers based on physical health problems were associated with reduced drinking and improved health outcomes (Israel et al., 1996; Kristenson et al., 1983; Willenbring and Olson, 1999). Finally, three randomized trials of interventions for unhealthy alcohol use found that the intervention was associated with improved outcomes for patients with an alcohol-related diagnosis but not for those without (Saitz et al., 2009; Walton et al., 2008; Weisner et al., 2001). Only one previous study that examined physical health and alcohol outcomes was conducted in medical inpatients with unhealthy alcohol use (Stewart and Connors, 2007). That study identified associations between readiness to change drinking and self-reported health status and alcohol-related physical consequences but found that only alcohol-related physical consequences were significantly associated with taking steps to change drinking (Stewart and Connors, 2007). Together, findings of previous studies suggest that poor physical health may motivate patients to consider changes in drinking and that, in combination with an intervention, alcohol-related illness can be a strong motivator of actual changes in drinking.

Our findings support and extend findings of previous studies in two ways. First, while the previous study in medical inpatients evaluated associations between self-reported physical health and readiness to change drinking (Stewart and Connors, 2007), our study evaluated associations between both self-report and medical-record-derived measures of physical health and patients' self-reported drinking 3 months after hospitalization. Though not statistically significant, estimates of associations between physical health and drinking went in the expected direction such that poorer physical health was associated with decreased drinking at follow-up. Second, we found that, independent of an intervention, admission to a hospital for a problem resulting from drinking was associated with less heavy drinking for non-dependent patients and those who did not perceive their excessive drinking to be problematic at the time of their hospitalization.

Several previous studies have demonstrated that high levels of readiness to change when defined as problem recognition are strongly correlated with more severe unhealthy alcohol use (Maisto et al., 2001; Samet and O'Connor, 1998; Williams et al., 2007; Williams et al., 2006). And, although some measures of readiness to change predict decreases in drinking (Heather et al., 1993; Williams et al., 2007), greater Problem Perception has previously been demonstrated to predict *increases* in drinking (Bertholet et al., 2009a). Further, decreasing drinking may be more difficult for and require more intensive interventions with patients with alcohol dependence (Bischof et al., 2008; Fleming and Manwell, 1999). As such, our finding of decreased incidence of heavy drinking days among participants with non-dependent unhealthy alcohol use who may have become aware of consequences of their drinking, but not among participants with alcohol dependence, is consistent with prior research.

We expected but did not find that poor physical health would be associated with decreased drinking among all participants. It could be that the relationship between health and drinking is more complex or that the expected associations are weaker than expected and thus were not statistically significant in this relatively small sample. Our finding that having an alcohol-attributable principal admitting diagnosis was associated with decreased drinking in subgroups of patients may have clinical implications. Brief alcohol counseling interventions that have reliably decreased alcohol consumption in primary care patients do not have confirmed efficacy for medical inpatients with unhealthy alcohol use (Emmen et al., 2004; Freyer-Adam et al., 2008; Holloway et al., 2007; Saitz et al., 2009; Saitz et al., 2007). Although further research is needed to confirm this, our findings suggest that being hospitalized for an alcohol-attributable illness may serve as a catalyst of change (Orford et al., 2006) for someone whose drinking or perception of drinking is more malleable to begin with (i.e., patients without dependence or who have little recognition upon hospital admission of their unhealthy drinking). As such, it could be that hospitalizations for alcohol-attributable illness may be a meaningful aspect to focus on during brief interventions for inpatients with less severe unhealthy alcohol use. But, most patients identified by alcohol screening in hospital settings are alcohol dependent (Saitz et al., 2006), a phenomenon which could account for lack of efficacy of brief interventions in this population (Guth et al., 2008). Further, 45 of the 51 (88%) patients who were hospitalized for alcohol-attributable illnesses in this study met criteria for alcohol dependence, and results of this study suggest that alcohol-attributable illness was not a strong catalyst of change for these patients. However, the study did not address whether an *intervention* focused on poor physical health impacted drinking outcomes. It could be that building upon the presence of an alcohol-attributable illness, or focusing on alcohol-related symptoms or problems (such as trauma) in the absence of alcohol-attributable illness, during brief interventions in hospital settings would help catalyze change for all patients along the spectrum of unhealthy alcohol use.

This study is limited in several ways. First, these analyses were conducted in a cohort of patients who consented to participate in a randomized controlled trial, which may limit the generalizability of findings. However, those who enrolled were identified by screening all medical inpatients. In addition, the parent study was not designed to answer the questions posed and, therefore, our ability to detect associations of the observed magnitude was limited both in the overall analyses and particularly in subgroup analyses exploring effect modification. In particular, the group of patients who were not alcohol-dependent, for whom changes in drinking may be easier than they are for alcohol dependent patients, was small, which may have limited our ability to detect important associations (although it was in this group that we did find an association between physical health and drinking). Future research should be pursued to confirm the results of this exploratory study. However, we found that, in exploring whether multiple dimensions of physical health were associated with changes in drinking, point estimates generally went in the expected direction, some results were significant, and consistent patterns emerged in subgroup analyses. Finally, the observational nature of our data makes us unable to determine a causal association between poor physical health and subsequent drinking. However, because it is impossible to randomize patients to medical illnesses or perceptions of their physical health status as poor, prospective data collection and adjusted analyses as in this study may be the best way to answer the research question.

Despite the limitations, some conclusions can be drawn from these findings, which merit further research. Some dimensions of physical health (e.g., medical illness) may not be associated with subsequent drinking among medical inpatients with unhealthy alcohol use. However, among participants with non-dependent unhealthy alcohol use and those less aware that they are drinking at unhealthy levels, being admitted to the hospital for an alcohol-attributable diagnosis was associated with less heavy drinking. Although further

research should confirm these findings, they suggest that, among medical inpatients with less severe unhealthy alcohol use, medical illness attributable to alcohol use may serve as a catalyst for positive changes in drinking. Hospital clinicians may be uniquely positioned to offer assistance to inpatients with less severe unhealthy alcohol use by helping patients to recognize a link between their drinking and medical diagnoses.

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References Cited

Adams WL, Yuan Z, Barboriak JJ, Rimm AA. Alcohol-related hospitalizations of elderly people. Prevalence and geographic variation in the United States [published erratum appears in JAMA 1993 Nov 3;270(17):2055]. JAMA 1993;270(10):1222–1225. [PubMed: 8355385]

American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders. 4th Edition. American Psychiatric Association; Washington D.C.: 1994.

Bertholet N, Cheng DM, Palfai TP, Samet JH, Saitz R. Does readiness to change predict subsequent alcohol consumption in medical inpatients with unhealthy alcohol use? Addict Behav 2009a;34(8): 636–40. [PubMed: 19428189]

Bertholet N, Dukes K, Horton NJ, Palfai TP, Pedley A, Saitz R. Factor structure of the SOCRATES questionnaire in hospitalized medical patients. Addict Behav. 2009b

Bischof G, Grothues JM, Reinhardt S, Meyer C, John U, Rumpf HJ. Evaluation of a telephone-based stepped care intervention for alcohol-related disorders: a randomized controlled trial. Drug Alcohol Depend 2008;93(3):244–51. [PubMed: 18054443]

Blow FC, Walton MA, Barry KL, Coyne JC, Mudd SA, Copeland LA. The relationship between alcohol problems and health functioning of older adults in primary care settings. J Am Geriatr Soc 2000;48(7):769–74. [PubMed: 10894315]

Bridevaux IP, Bradley KA, Bryson CL, McDonell MB, Fihn SD. Alcohol screening results in elderly male veterans: association with health status and mortality. J Am Geriatr Soc 2004;52(9):1510–7. [PubMed: 15341553]

Charlson M, Szatrowski TP, Peterson J, Gold J. Validation of a combined comorbidity index. J Clin Epidemiol 1994;47(11):1245–51. [PubMed: 7722560]

Chick J, Lloyd G, Crombie E. Counselling problem drinkers in medical wards: a controlled study. BMJ 1985;290:965–967. [PubMed: 2858246]

Chou SP, Grant BF, Dawson DA. Medical consequences of alcohol consumption--United States, 1992. Alcohol Clin Exp Res 1996;20(8):1423–9. [PubMed: 8947320]

Dawson DA, Grant BF, Stinson FS, Chou PS, Huang B, Ruan WJ. Recovery from DSM-IV alcohol dependence: United States, 2001–2002. Addiction 2005;100(3):281–92. [PubMed: 15733237]

DiMartini A, Weinrieb R, Fireman M. Liver transplantation in patients with alcohol and other substance use disorders. Psychiatr Clin North Am 2002;25(1):195–209. [PubMed: 11912940]

Elvy GA, Wells JE, Baird KA. Attempted referral as intervention for problem drinking in the general hospital. Br J Addict 1988;83:83–89. [PubMed: 3345386]

Emmen MJ, Schippers GM, Bleijenberg G, Wollersheim H. Effectiveness of opportunistic brief interventions for problem drinking in a general hospital setting: systematic review. Bmj 2004;328(7435):318. [PubMed: 14729657]

Figlie NB, Dunn J, Gomes LC, Turisco J, Paya R, Laranjeira R. Motivation to change drinking behavior: the differences between alcohol users from an outpatient gastroenterology clinic and a specialist alcohol treatment service. Sao Paulo Med J 2005;123(5):223–8. [PubMed: 16358097]

Fleming M, Brown R, Brown D. The efficacy of a brief alcohol intervention combined with %CDT feedback in patients being treated for type 2 diabetes and/or hypertension. J Stud Alcohol 2004;65(5):631–7. [PubMed: 15536773]

Fleming MF, Manwell LB. Brief intervention in primary care settings: A primary treatment method for at-risk, problem, and dependent drinkers. Alcohol Res Health 1999;23(2):128–137. [PubMed: 10890807]

Freyer-Adam J, Coder B, Baumeister SE, Bischof G, Riedel J, Paatsch K, Wedler B, Rumpf HJ, John U, Hapke U. Brief alcohol intervention for general hospital inpatients: a randomized controlled trial. Drug Alcohol Depend 2008;93(3):233–43. [PubMed: 18054445]

Green CA, Perrin NA, Polen MR. Gender differences in the relationships between multiple measures of alcohol consumption and physical and mental health. Alc Clin Exp Res 2004;28(5):754–764.

Guth S, Lindberg SA, Badger GJ, Thomas CS, Rose GL, Helzer JE. Brief intervention in alcohol-dependent versus nondependent individuals. J Stud Alcohol Drugs 2008;69(2):243–50. [PubMed: 18299765]

Heather N, Rollnick S, Bell A. Predictive validity of the Readiness to Change Questionnaire. Addiction 1993;88:1667–77. [PubMed: 8130706]

Heather N, Rollnick S, Bell A, Richmond R. Effects of brief counselling among male heavy drinkers identified on general hospital wards. Drug & Alc Rev 1996;15:29–38.

Holloway AS, Watson HE, Arthur AJ, Starr G, McFadyen AK, McIntosh J. The effect of brief interventions on alcohol consumption among heavy drinkers in a general hospital setting. Addiction 2007;102(11):1762–70. [PubMed: 17784901]

Israel Y, Hollander O, Sanchez-Craig M, Booker S, Miller V, Gingrich R, Rankin JG. Screening for problem drinking and counseling by the primary care physician-nurse team. Alcohol Clin Exp Res 1996;20(8):1443–1450. [PubMed: 8947323]

Katz JN, Chang LC, Sangha O, Fossel AH, Bates DW. Can comorbidity be measured by questionnaire rather than medical record review? Med Care 1996;34(1):73–84. [PubMed: 8551813]

Kelly M, Chick J, Gribble R, Gleeson M, Holton M, Winstanley J, McCaughan GW, Haber PS. Predictors of relapse to harmful alcohol after orthotopic liver transplantation. Alcohol Alcohol 2006;41(3):278–83. [PubMed: 16476764]

Kristenson H, Ohlin H, Hulten-Nosslin M, Trell E, Hood B. Identification and intervention of heavy drinking in middle-aged men: results and follow-up of 24–60 months of long-term study with randomized controls. Alcohol Clin Exp Res 1983;7(2):203–209. [PubMed: 6135365]

Kristenson H, Osterling A, Nilsson JA, Lindgarde F. Prevention of alcohol-related deaths in middle-aged heavy drinkers. Alcohol Clin Exp Res 2002;26(4):478–84. [PubMed: 11981123]

Maheswaran R, Beevers M, Beevers DG. Effectiveness of advice to reduce alcohol consumption in hypertensive patients. Hypertension 1992;19:79–84. [PubMed: 1346121]

Maisto SA, Conigliaro J, McNeil M, Kraemer K, Conigliaro RL, Kelley ME. Effects of two types of brief intervention and readiness to change on alcohol use in hazardous drinkers. J of Studies on Alc 2001;62(5):605–14.

Maisto SA, Conligliaro J, McNeil M, Kraemer KL, O'Connor M, Kelley ME. Factor structure of the SOCRATES in a sample of primary care patients. Addictive behaviors 1999;24(6):879–92. [PubMed: 10628520]

McQueen J, Howe TE, Allan L, Mains D. Brief interventions for heavy alcohol users admitted to general hospital wards. Cochrane Database Syst Rev 2009;(3):CD005191. [PubMed: 19588369]

Miller WR, Tonigan JS. Assessing Drinkers Motivation for Change: The stages of Change Readiness and Treatment Eagerness Scale (SOCRATES). Psychol Addictive Behav 1996;10(2):81–9.

Moos RH, Moos BS. Rates and predictors of relapse after natural and treated remission from alcohol use disorders. Addiction 2006;101(2):212–22. [PubMed: 16445550]

National Institute on Alcohol Abuse and Alcoholism. US Department of Health and Human Services. National Institute of Health. Helping Patients Who Drink Too Much: A Clinician's Guide (updated 2005 guide). 2007.

Orford J, Hawker A. An investigation of an alcoholism rehabilitation halfway house: II the complex question of client motivation. Br J Addict Alcohol Other Drugs 1974;69(4):315–23. [PubMed: 4532046]

Orford J, Hodgson R, Copello A, John B, Smith M, Black R, Fryer K, Handforth L, Alwyn T, Kerr C, Thistlethwaite G, Slegg G. The clients' perspective on change during treatment for an alcohol problem: qualitative analysis of follow-up interviews in the UK Alcohol Treatment Trial. Addiction 2006;101(1):60–8. [PubMed: 16393192]

Orford J, Hodgson R, Copello A, Wilton S, Slegg G. To what factors do clients attribute change? Content analysis of follow-up interviews with clients of the UK Alcohol Treatment Trial. J Subst Abuse Treat. 2008

Persson J, Magnusson P. Early intervention in patients with excessive consumption of alcohol: a controlled study. Alcohol 1989;6:403–408. [PubMed: 2573364]

Pomerleau CS, Carton SM, Lutzke ML, Flessland KA, Pomerleau OF. Reliability of the Fagerstrom Tolerance Questionnaire and the Fagerstrom Test for Nicotine Dependence. Addict Behav 1994;19(1):33–9. [PubMed: 8197891]

Rehm J, Room R, Graham K, Monteiro M, Gmel G, Sempos CT. The relationship of average volume of alcohol consumption and patterns of drinking to burden of disease: an overview. Addiction 2003;98:1209–1228. [PubMed: 12930209]

Robins LN, Wing J, Wittchen HU, Helzer JE, Babor TF, Burke J, Farmer A, Jablenski A, Pickens R, Regier DA. The Composite International Diagnostic Interview. An epidemiologic Instrument suitable for use in conjunction with different diagnostic systems and in different cultures. Arch Gen Psychiatry 1988;45(12):1069–77. [PubMed: 2848472]

Room R, Babor T, Rehm J. Alcohol and public health. Lancet 2005;365(9458):519–30. [PubMed: 15705462]

Saitz R. Clinical practice. Unhealthy alcohol use. N Engl J Med 2005;352(6):596–607. [PubMed: 15703424]

Saitz R, Freedner N, Palfai TP, Horton NJ, Samet JH. The severity of unhealthy alcohol use in hospitalized medical patients. The spectrum is narrow. J Gen Intern Med 2006;21(4):381–5. [PubMed: 16686818]

Saitz R, Palfai TP, Cheng DM, Horton NJ, Dukes K, Kraemer KL, Roberts MS, Guerriero RT, Samet JH. Some medical inpatients with unhealthy alcohol use may benefit from brief intervention. J Stud Alcohol Drugs 2009;70(3):426–35. [PubMed: 19371494]

Saitz R, Palfai TP, Cheng DM, Horton NJ, Freedner N, Dukes K, Kraemer KL, Roberts MS, Guerriero RT, Samet JH. Brief intervention for medical inpatients with unhealthy alcohol use: a randomized, controlled trial. Ann Intern Med 2007;146(3):167–76. [PubMed: 17283347]

Samet JH, O'Connor PG. Alcohol abusers in primary care: readiness to change behavior. Am J Med 1998;105(4):302–6. [PubMed: 9809691]

Smith KL, Horton NJ, Saitz R, Samet JH. The use of the mini-mental state examination in recruitment for substance abuse research studies. Drug Alcohol Depend 2006;82(3):231–7. [PubMed: 16256278]

Smothers BA, Yahr HT, Sinclair MD. Prevalence of current DSM-IV alcohol use disorders in short-stay, general hospital admissions, United States, 1994. Arch Intern Med 2003;163(6):713–9. [PubMed: 12639205]

Sobell LC, Sobell MB, Leo GI, Cancilla A. Reliability of a Timeline Method: assessing normal drinkers' reports of recent drinking and a comparative evaluation across several populations. Br J Addict 1988;83:393–402. [PubMed: 3395719]

Solberg LI, Maciosek MV, Edwards NM. Primary care intervention to reduce alcohol misuse ranking its health impact and cost effectiveness. Am J Prev Med 2008;34(2):143–152. [PubMed: 18201645]

StataCorp.. Stata Statistical Software: Release Special Edition 10.1. Stata Corporation; College Station TX: 2007.

Stein MD. Medical consequences of substance abuse. Psychiatr Clin North Am 1999;22(2):351–70. [PubMed: 10385938]

Stewart SH, Connors GJ. Perceived health status, alcohol-related problems, and readiness to change among medically hospitalized, alcohol-dependent patients. J Hosp Med 2007;2(6):372–7. [PubMed: 18080338]

Tsui JI, Saitz R, Cheng DM, Nunes D, Libman H, Alperen JK, Samet JH. Awareness of hepatitis C diagnosis is associated with less alcohol use among persons co-infected with HIV. J Gen Intern Med 2007;22(6):822–5. [PubMed: 17503108]

Vielva I, Iraurgi I. Cognitive and behavioural factors as predictors of abstinence following treatment for alcohol dependence. Addiction 2001;96(2):297–303. [PubMed: 11182875]

Walton MA, Blow FC, Bingham CR, Chermack ST. Individual and social/environmental predictors of alcohol and drug use 2 years following substance abuse treatment. Addict Behav 2003;28(4):627–42. [PubMed: 12726780]

Walton MA, Goldstein AL, Chermack ST, McCammon RJ, Cunningham RM, Barry KL, Blow FC. Brief alcohol intervention in the emergency department: moderators of effectiveness. J Stud Alcohol Drugs 2008;69(4):550–60. [PubMed: 18612571]

Ware J Jr. Kosinski M, Keller SD. A 12-Item Short-Form Health Survey: construction of scales and preliminary tests of reliability and validity. Med Care 1996;34(3):220–33. [PubMed: 8628042]

Weisner C, Mertens J, Parthasarathy S, Moore C, Lu Y. Integrating primary medical care with addiction treatment: A randomized controlled trial. JAMA 2001;286(14):1715–1723. [PubMed: 11594896]

Willenbring ML, Olson DH. A randomized trial of integrated outpatient treatment for medically ill alcoholic men. Arch Intern Med 1999;159(16):1946–52. [PubMed: 10493326]

Williams EC, Horton NJ, Samet JH, Saitz R. Do brief measures of readiness to change predict alcohol consumption and consequences in primary care patients with unhealthy alcohol use? Alcohol Clin Exp Res 2007;31(3):428–35. [PubMed: 17295727]

Williams EC, Kivlahan DR, Saitz R, Merrill JO, Achtmeyer CE, McCormick KA, Bradley KA. Readiness to change in primary care patients who screened positive for alcohol misuse. Annals Fam Med 2006;4(3):213–220.

Williams EC, Peytremann-Bridevaux I, Fan VS, Bryson CL, Kivlahan DR, Bradley KA. The association between alcohol screening scores and self-reported health status in male veterans. Journal of Addiction Medicine. In press.

Table 1

Participant Characteristics at Baseline (n=341)

	Mean (SD)
Age	44 (11)

	N (%)
Female	99 (29)
Race	
Hispanic	30 (9)
Black	155 (45)
White	133 (39)
Other	23 (7)
Smoking Status	
Never	48 (14)
Current	257 (75)
Past	36 (11)
Heavy Drinking Days (in the prior 30 days)	
0–1	59 (17)
2–14	152 (45)
≥15	130 (38)
Median Drinks/day	3.6
Alcohol Dependent	261 (77)
Alcohol Abuse	15 (4)

	Mean (SD)
Problem Perception (Range 10–50)	35 (11)
Low, score ≤38 (n=172)	26 (9)
High, score >38 (n=166)	44 (4)
Taking Action (Range 6–30)	21 (6)
Low, score ≤25 (n=255)	19 (5)
High, score >25 (n=85)	28 (2)

	Mean (SD)
Physical Health Status (PCS score; Range 17.8–61.9)	38 (9)
(Worst Health) Quintile 1 (17.8 – 30.3)	26 (3)
Quintile 2 (30.4 – 34.5)	33 (1)
Quintile 3 (34.6 – 39.4)	37 (1)
Quintile 4 (39.5 – 36.0)	43 (2)

	Mean (SD)
(Best Health) Quintile 5 (46.2 – 61.9)	52 (4)

	N (%)
Recent # Medical Comorbidities	
0	148 (48)
1	96 (31)
≥2	67 (22)
Lifetime # Medical Comorbidities	
0	107 (34)
1	102 (33)
≥2	104 (33)
Any Alcohol-attributable Medical Diagnosis	156 (46)
Alcohol-attributable Principal Admitting Diagnosis	51 (15)

Table 2

Unadjusted and Adjusted Associations between Measures of Physical Health and 3-month Drinking Outcomes

	30 Day Abstinence*^				Number of Heavy Drinking Days**^			
	Unadjusted Models		Adjusted Models		Unadjusted Models		Adjusted Models	
	OR	95% CI	OR	95% CI	IRR	95% CI	IRR	95% CI
Recent # of Medical Comorbidities								
0	---	---	---	---	---	---	---	---
1	1.60	0.78 –3.29	1.69	0.80 – 3.59	1.04	0.75 – 1.43	0.93	0.66 – 1.31
≥2	1.51	0.67 – 3.39	1.44	0.62 – 3.34	1.34	0.90 – 1.98	1.18	0.78 – 1.79
Lifetime # of Medical Comorbidities								
0	---	---	---	---	---	---	---	---
1	1.04	0.48 – 2.25	1.13	0.51 – 2.51	1.03	0.75 – 1.40	0.95	0.68 – 1.32
≥2	1.26	0.59 – 2.70	1.15	0.51 – 2.58	1.22	0.84 – 1.77	1.10	0.73 – 1.64
Physical Health Status								
Quintile 1	3.35	1.25 – 8.96	2.81	0.98 – 8.00	1.07	0.66 – 1.71	0.96	0.60 – 1.54
Quintile 2	1.34	0.47 – 3.82	1.00	0.32 – 3.03	1.24	0.81 – 1.89	1.18	0.78 – 1.80
Quintile 3	1.54	0.54 – 4.33	1.10	0.36 – 3.38	1.09	0.72 – 1.65	1.04	0.67 – 1.61
Quintile 4	1.95	0.71 – 5.37	1.74	0.61 – 4.95	1.00	0.66 – 1.52	0.96	0.63 – 1.45
Quintile 5	---	---	---	---	---	---	---	---
Any Alcohol-Attributable Medical Diagnosis	1.26	0.71 – 2.23	1.13	0.60 – 2.10	0.90	0.66 – 1.22	0.83	0.60 – 1.14
Alcohol-Attributable Principal Admitting Diagnosis	1.81	0.87 – 3.76	1.87	0.85 – 4.11	0.97	0.65 – 1.44	0.88	0.58 – 1.33

* adjusted models included age, gender, race, smoking status, randomization group, alcohol dependence, and drinks/day at baseline

** all models were adjusted for heaving drinking days at baseline; adjusted models also include age, gender, race, smoking status, randomization group, and alcohol dependence

^ p-values for all associations were all >0.05. P-values obtained for categorical independent variables were the result of tests of trend; p-values obtained for dichotomous independent variables were the results of Wald tests.

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Table 3

Results of tests of effect modification: p-values for interactions between measures of physical health and alcohol dependence and readiness to change (significant results are bolded).

Independent Variables^	30-Day Abstinence*			# Heavy Drinking Days**		
	Dependent	Problem Perception	Taking Action	Dependent	Problem Perception	Taking Action
Recent # of Medical Comorbidities						
Unadjusted	0.67	0.73	0.56	0.76	0.52	0.16
Adjusted	0.71	0.74	0.66	0.60	0.62	0.12
Lifetime # of Medical Comorbidities						
Unadjusted	0.19	0.90	0.90	0.09	0.75	0.95
Adjusted	0.25	0.85	0.80	0.08	0.72	0.98
Physical Health Status						
Unadjusted	0.83	0.27	0.12	0.28	**0.02**	0.87
Adjusted	0.87	0.21	0.09	0.21	**0.01**	0.85
Any Alcohol-Attributable Medical Diagnosis						
Unadjusted	**0.04**	0.80	0.18	0.12	0.17	0.75
Adjusted	0.05	0.83	0.08	0.12	0.22	0.91
Alcohol-Attributable Principal Admission						
Unadjusted	0.94	0.70	0.18	**0.04**	0.07	0.13
Adjusted	0.92	0.70	0.06	**0.02**	**0.04**	**0.03**

^Medical comorbidities (both recent and lifetime) modeled categorically (0,1, ≥ 2) with 0 the referent; Physical Health Status modeled categorically in Quintiles (Quintile 5 referent); Alcohol-Attributable diagnoses (both any and principal admission) modeled dichotomously.

*adjusted models included age, gender, race, smoking status, randomization group, alcohol dependence, and drinks/day at baseline

**all models were adjusted for heaving drinking days at baseline; adjusted models also include age, gender, race, smoking status, randomization group, and alcohol dependence

Table 4

Associations between Alcohol-Attributable Principal Admitting Diagnosis and number of heavy drinking days stratified by Alcohol Dependence and Problem Perception (significant results are bolded)

	Non Dependent (N=58)	Dependent (N=214)	Low Problem Perception (N=132)	High Problem Perception (N=137)
	N (%)	N (%)	N (%)	N (%)
Alcohol-Attributable Principal Admitting Diagnosis	4 (7)	37 (17)	9 (7)	30 (22)

	IRR (95% CI)	IRR (95% CI)	IRR (95% CI)	IRR (95% CI)
Unadjusted*	**0.15 (0.04 – 0.56)**	1.04 (0.71 – 1.53)	**0.46 (0.21 – 1.00)**	1.10 (0.83 – 1.67)
Adjusted**	**0.10 (0.03 – 0.32)**	0.94 (0.62 – 1.42)	**0.36 (0.13 – 0.99)**	1.02 (0.61 – 1.71)

* adjusted for heaving drinking days at baseline

** adjusted for age, gender, race, smoking status, randomization group, heaving drinking days at baseline, and alcohol dependence