Readiness to Change and Risk-Drinking Women

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Abstract

The predictive value of the Readiness to Change Questionnaire (RTCQ) for subsequent drinking was evaluated in 499 women. These women had medical problems potentially exacerbated by alcohol use and were enrolled in an intervention study. Correlates and predictors of stage-of-change were analyzed. Results indicated that the categorical application of the RTCQ did not predict drinking in the 6–12 months after enrollment. Preliminary findings support rescoring the RTCQ into a continuous measure. Following this conversion, situational risks factors for drinking were examined as potential mediators of RTC. Heightened risk for alcohol consumption during an argument or boredom was found to attenuate the association between one's RTC and later drinking. Finally, medical condition moderated the association of RTC on later drinking; women with diabetes, infertility or osteoporosis drank the most in the contemplation stage. In contrast, hypertensive women drank most when action-oriented to change. The implications for intervening with risk-drinking women are discussed.

1. INTRODUCTION

Understanding the processes that drive change in alcohol consumption is an area of active inquiry (Huebner & Tonigan, 2007). While the processes may be psychological, social, or neuropsychological, the shift in emphasis from *whether* people change to *how* people change reflects advances in alcohol treatment and the desire to improve outcome (Willenbring, 2007).

Readiness to change (RTC) has been conceptualized as a combination of a patient's perceived importance of a problem and confidence in his or her ability to change, and is a central tenet of the Transtheoretical Model of intentional change (DiClemente, Schlundt, & Gemmell, 2004). This stage of change model addresses the underlying motivational processes that drive people to modify their behavior and proposes that the process of change is based on progression through distinct qualitative stages of change. RTC can be measured using the brief Readiness to Change Questionnaire, where 12 items are rated on a five-point scale, ranging from strongly agree to strongly disagree (RTCQ; Heather, Gold, & Rollnick, 1991). This measure consists of three subscales (four items each) that correspond to the pre-contemplation (e.g., "I don't think I drink too much"), contemplation (e.g., "I enjoy my drinking but sometimes drink too much"), and action (e.g., "I am trying to drink less than I used to") stages of change. The RTCQ assigns the individual to one of the three stages of

change, using either the quick (assigning the individual to the stage having the highest raw score) or refined (performing profile analysis of scores across the three scales) method of allocation (Hannover et al., 2002). The measure was developed primarily for use with hazardous drinkers who are unaware that they have an alcohol problem and so are not - treatment seeking. It provides a means of assessing a drinker's readiness to change quantity and frequency of drinking. Readiness ranges from less readiness, with no problem recognition, to greater readiness, as manifested by considering, or actually making, behavior changes (Forsberg, Halldin, & Wennberg, 2003).

Readiness to change has been studied as a predictor of later drinking reduction (Borsari, Murphy, & Carey, 2009), as a mechanism of drinking change (Freyer et al., 2005), and as a mediator of treatment (Stein et al., 2009). Several investigators have examined the utility of RTC stages as a predictor of drinking by women in particular. Although women have had lower rates of alcohol use disorders than men, the gender gap for drinking problems is narrowing (Hasin, Stinson, Ogburn, & Grant, 2007; Keyes, Brant, & Hasin, 2008). Women are more vulnerable to the negative medical consequences of alcohol because of metabolic differences, and as a result suffer serious negative consequences from alcohol consumption earlier, and to a greater degree, than men (Nolen-Hoeksema, 2004).

One of the first studies to focus on women drinkers classified 119 treatment seeking alcohol dependent women into Contemplation or Action stages at study enrollment, before treatment. Those who had greater readiness to change perceived more advantages, and fewer disadvantages of changing their drinking behavior (Share, 2004). A later study of 301 pregnant women who were not seeking alcohol treatment found that stage of change did not predict subsequent prenatal alcohol use. However, stage of change designation was associated with different patterns of drinking before pregnancy in that sample. In other words, those in the pre-contemplation stage drank more per episode and more often, than those in the action stage before pregnancy (Chang, McNamara, Wilkins-Haug, & Orav, 2007). More recently, a study of 285 non-treatment seeking female college students sought to determine under what circumstances, RTC varied within individuals (Kaysen, Lee, LaBrie, & Tollison, 2009). Findings revealed that changes in RTC were not consistently predictive of subsequent drinking behaviors.

Budd and Rollnick (1996) have suggested that the RTCQ lacks discriminant validity, and have shown that the three stages of change are not related in a simplex structure. This statistical finding is supported by the observation that individuals typically do not progress through the stages of change in the invariant sequence the model hypothesizes (Sutton, 1996). As such, it has been suggested that construing RTC as a continuous variable (rather than as a series of discrete stages) may be a more parsimonious formation of this construct. In fact, Budd and Rollnick (1996) have shown that the RTCQ items can be re-scored to form a valid and reliable continuous measure of RTC.

Similarly, when we consider that the RTCQ is not always predictive of consumption (Gavin, Sobell, & Sobell, 1998), it is possible that the effects of RTC as a predictor of subsequent drinking behavior may be mediated or moderated by other factors. For example, impediments to self- or outcome-efficacy may adversely impact attempts to reduce drinking. This is supported by findings that measures of craving have been demonstrated to be a useful means of predicting drinking (Flannery, Poole, Gallop, & Volpicelli, 2003). Therefore, if cravings for alcohol are higher, then little behavior change might be expected as the barriers to change are greater. Similarly, sensitivity to situational risk factors may lead to reduced behavior change, as the individual encounters more frequent obstacles to initiating, and then maintaining, behavior changes. In addition, it is possible that personal variables interact with one's RTC, so that these factors may systematically increase or

reduce the predictive value of the RTCQ. For example, it is possible that the effect of RTC on follow-up drinking is dependent on the medical condition for which participants were seeking treatment. This is especially plausible when we consider that these medical problems (diabetes, hypertension, infertility, or osteoporosis) are potentially exacerbated by excessive alcohol use.

The results of studies focusing on women drinkers are similar to others of more general populations, which have found that stage of change status neither predicts participation in treatment nor drinking behavior change outcomes (DiClemente, Schlundt, & Gemmell, 2004). Hence additional study about the stages of change, and specifically, its measurement in comparison to continuous readiness have been recommended, given the enduring popularity of the Transtheoretical Model of intentional behavior change and the continued need to understand motivation in drinking behavior change.

1.2 STUDY PURPOSE

The purpose of this study is to evaluate the efficacy of the Readiness to Change Questionnaire as a predictor of drinking change in a sample of 499 adult women with medical problems potentially exacerbated by excessive alcohol use. In addition, we sought to analyze the correlates and predictors of stage of change in this non-treatment seeking sample. Our specific hypotheses were as follows:

H1 RTCQ stage of change designations will not predict drinking behavior in the 6 to 12 month period following study enrollment amongst non-treatment seeking adult women with medical problems potentially exacerbated by alcohol consumption.

H2 Re-scoring the RTCQ by combining items to form a homogenous scale, in order to treat RTC as a continuous variable will increase the predictive value of this construct on drinking behavior in the 6 to 12 month period following study enrollment amongst non-treatment seeking adult women.

H3 Situational risk factors (e.g., increased risk for drinking when bored; increased risk for drinking following an argument) for drinking, and levels of weekly craving (as measured on a visual analogue scale), will mediate the predictive value of one's (continuous) RTC score.

H4 Medical diagnoses (diabetes, hypertension, infertility, or osteoporosis) potentially exacerbated by excessive alcohol use will moderate the predictive value of the RTCQ.

2.0 METHODS

2.1 PARTICIPANTS

Participants were 499 of 511 (97%) women enrolled in a randomized trial of brief intervention for risk drinking; 12 of the 511 did not complete the Readiness to Change Questionnaire and were therefore excluded from analyses. Overall, 96% completed the study, which included follow-up interviews 12 months after enrollment. Participants were randomized to receive either a single session brief intervention or treatment as usual, following the enrollment interview. There were no differences in drinking outcomes by treatment group assignment (Chang, 2009).

Participants were women receiving outpatient treatment for diabetes, hypertension, osteoporosis, or infertility, but they were not seeking alcohol treatment. They met eligibility criteria for the clinical trial, which included: 1) medical diagnosis confirmed by a physician,

2) sufficient command of English to comprehend and complete study questionnaires, 3) no current treatment for alcohol or drug use disorders, 4) no current physical dependence on alcohol or other substances, and 5) not currently pregnant or nursing. In addition, participants needed to consume alcohol at levels exceeding the NIAAA sensible drinking limits in the past 6 months, or to be T-ACE alcohol screen positive. The NIAAA Sensible Drinking Limits for adult women up to age 65 are no more than seven standard drinks per week and no more than three standard drinks per day (U.S. Department of Health & Human Services, NIH, & NIAAA, 2007). The T-ACE asks four questions (T=how many drinks does it take for you to feel high (**tolerance**)?; A=have people **annoyed** you by talking about your drinking; C= have you tried to **cut down** on your drinking; and E= have you ever had a drink first thing in the morning to steady your nerves or get rid of a hang-over (**eye-opener**)?) and was scored using the standard cut-off of two (or more) points (Sokol, Martier, & Ager, 1989). Additional details about the study are available elsewhere (Chang, Fisher, Hornstein, Jones, & Orav, 2010).

2.2 MEASURES

Participants completed a series of measures at enrollment, during the brief intervention, and at study follow-up. Enrollment measures included: 1) the alcohol and drug abuse modules from the Structured Clinical Interview for DSM-IV (SCID; First, Spitzer, Gibbon, & Williams, 2002), to obtain current and lifetime alcohol and drug disorder diagnoses; 2) the alcohol timeline followback (TLFB; Sobell & Sobell, 1992), to obtain estimates of daily drinking for the six months prior to study enrollment; 3) the Readiness to Change Questionnaire (RTCQ; Rollnick, Heather, Gold, & Hall, 1992), 12-items to assess an individual's readiness to change drinking by using the quick method of assignment to one of three stages of change (Heather, Rollnick. & Bell, 1993). The stages are pre-contemplation (no interest in change), contemplation (considering a change), and action (making a change); 4) Craving Scales (visual analogue 100mm line on which participants indicate the intensity of their desire to drink) to estimate the intensity of cravings for alcohol, currently (NOW) and in the past week (PAST); and 5) the Perceived Stress Scale (PSS; Cohen & Williamson, 1988) to measure the perception and experience of stress in one's life during the past month.

Following enrollment, women in the brief intervention group were asked to name a drinking goal (e.g., no change, reduce, abstain), to identify situations that would put them at risk for alcohol consumption (e.g., during an argument, feeling bored, others are drinking, feeling depressed, feeling lonely, feeling anxious, want to have fun), and to list behaviors they could pursue instead of drinking (e.g., calling a friend, having a snack, exercising, watching TV). The women's responses were documented on the brief intervention summary sheet and then tabulated.

At 12-month follow-up, participants completed the TLFB for drinking history of the preceding six months (months 6–12 after enrollment), the PSS, and the Craving Scales, all already described. From the TLFB self-report measure of drinking history, four drinking outcomes were calculated: 1) drinks per drinking day, 2) percent drinking days, 3) number of binge episodes defined as 4 or more drinks per occasion, and 4) number of weeks exceeding NIAAA Sensible Drinking Limits for women. Baseline alcohol use was calculated using the TLFB data for the six months prior to enrollment. Drinking at follow-up was calculated using the TLFB data for the previous six months.

This study was reviewed and approved by the Partners Institutional Review Board (2004-p-000687). Participants received an honorarium of $50.00 for the enrollment and follow-up interviews. A federal Certificate of Confidentiality as obtained (AA-30-2005) as well. The Clinicaltrials.gov Identifier for the umbrella study is NCT00846638.

2.2 DATA ANALYSIS

All analyses were carried out using the SPSS statistical package (version 14.0). Simple descriptive statistics were calculated and are reported as percentages, means, and standard deviations (SD), as appropriate.

2.3 a Descriptive outcome measures

Differences in alcohol use at baseline and follow-up were examined with paired sample t-tests.

2.3 b Analyzing H1: Predictive value of RTCQ

The RTCQ was evaluated as a measure of discrete stages of readiness to change. Participant responses on the RTCQ were scored according to the procedures outlined by the RTCQ user's manual (Heather, Gold, & Rollnick, 1991), including the instructions to reverse-score the pre-contemplation scale items. Based on these scores, participants were assigned to pre-contemplation, contemplation, or action stages with regard to their readiness to change their drinking habits (Allen & Columbus, 1995). Associations between the three RTCQ sub-scales were examined with correlations. Confirmatory factor analyses were employed to verify the internal consistency and reliability of the three RTCQ sub-categories in the current sample. To evaluate the RTCQ, a series of one-way ANOVAs were conducted examining the relationship between stage of change and the four drinking outcomes at follow-up (drinks per drinking day, percent drinking days, number of binge episodes, and number of weeks exceeding NIAAA Sensible Drinking Limits for women) based on alcohol consumption in the 6 to 12 months after enrollment. Furthermore, this analysis allowed us to determine whether the three RTC categories differed with regards to follow-up drinking behaviors.

2. 3 c Analyzing H2: RTCQ as a measure of continuous readiness of change

The RTCQ was further evaluated after a continuum of summed scores was used in place of the ordinal categories of readiness to change. Standard scoring procedures (Heather, Gold, & Rollnick, 1991) were maintained (e.g., pre-contemplation items were reverse-coded); however, whereas previously the individual was assigned to that stage that had the highest raw score, participant scores were now summed across subscales to create a single continuous measure of RTC. This method of combining all 12 RTCQ items to form a single continuous measure of RTC has been shown to be a reliable and valid predictor of later drinking behavior (Sutton, 1996). Following this conversion to continuous scores (where ascending values indicated movement towards action orientation), predictors of RTCQ were evaluated with stepwise regressions.

2. 3 d Analyzing H3 & H4: Examining mediators and moderators of the RTCQ

Situational risk factors and self-reported alcohol cravings were examined as potential mediators of RTC (see Figure 1) using Baron and Kenny's (1986) regression procedures. This method of analysis posits several requirements, which are: (1) The total effect of the independent variable (i.e., RTC score collected at enrollment) on the dependent variable (i.e., 6–12 month follow-up drinking behaviors) must be significant; (2) The path from the independent variable to the mediator (i.e., risk factors for drinking, collected at enrollment) must be significant; and (3) The path from the mediator to the dependent variable must be significant (i.e., must lead to a reduction in coefficient magnitude while controlling for the independent variable). In addition, there is a simultaneous fourth step, which is required to provide evidence for *complete* mediation. (4) This step stipulates that the independent variable must no longer have any effect on the dependent variable when the mediator has been controlled (i.e., the effect of RTC on follow-up drinking is reduced to zero when

controlling for the proposed mediator). It should be noted that the effects in both steps three and four are estimated in the same equation. Using these procedures, the meditational models depicted in Figure 1 were examined.

Finally, we examined the impact of four medical diagnoses (diabetes, hypertension, infertility, or osteoporosis) on stages of RTC. These medical problems are exacerbated by alcohol consumption, and may therefore affect the strength or form of the relationship between RTC stage designation and follow-up (6–12 month) drinking behaviors. Moderation was examined with standard ANOVA procedures, in a 4 (medical condition: diabetes, hypertension, infertility, or osteoporosis) X 3 (original categorical RTC designations: pre-contemplation, contemplation, action). These findings were replicated with multiple regression procedures, by creating the necessary interaction term (i.e., medical diagnosis X RTC continuous variable) and dummy variables (i.e., for the moderator and causal variables).

3. 0 RESULTS

3.1 Demographic and Clinical Characteristics

The average participant age was 45 (SD=13.6) years, with a range from 19 to 78. More than half were married (53%), completed at least 4 years of college (62%), and worked outside of the home (65%). Less than half (48%) had children at home. The women were diverse, with 73% being Caucasian, 22% African American, and 5% Hispanic. They had diabetes, 19%; hypertension, 31.5%; infertility, 32%; and osteoporosis, 17.5%. Almost half (49%) were overweight with an average body mass index of 27.3 (SD=7.5).

3. 2 Alcohol and Substance Use

Current and lifetime alcohol and drug disorder diagnoses were obtained from the alcohol and drug abuse modules of the Structured Clinical Interview for DSM-IV (SCID). Lifetime (43%) and current (9.3%) alcohol use disorders were the most common substance use diagnoses among participants. Lifetime and current marijuana (13% and 2.3% respectively) and cocaine (7% and 1.4%, respectively) use disorders were less frequent. Whereas 5.6% of the participants had lifetime sedative-hypnotic, stimulant and hallucinogen diagnoses, only 1% met criteria for current disorders. No participant satisfied diagnostic criteria for current opiate use disorders, but 2% had a lifetime history.

For the 6-month period prior to enrollment, the women averaged 2+ drinks per drinking day (D/DD) on 43 of 180 (24%) days. During this same six-month period, they had about one binge episode (4+ drinks) per month (or 6 binges in all), and had four weeks that exceeded any NIAAA Sensible Drinking Limits. Drinking patterns subsequent to enrollment were significantly lower, with an average of < 2 D/DD (t (489) = 4.06, p=.00) on 37 of 180 days (20%, t (489) = 3.27, p=.00). The total number of binge episodes was reduced to 4.5 (t (489)=1.93, p=.05) and the number of weeks that exceeded NIAAA Sensible Drinking Limits dropped to 3, in the final 6 months of study (t (489)=2.85, p=.00).

3. 3 a Readiness to Change Stages

The majority (64%) of women was classified to be in the pre-contemplation stage; 12% were in the contemplation stage and 24% were in the action stage. Mean scores on each subscale were pre-contemplation 0.9 (SD=3.6); contemplation 3.3 (SD=4.1), and action 1.4 (SD=4.5). Subscale correlations were: pre-contemplation and contemplation, r=.55; pre-contemplation and action, r=.29; and contemplation and action; r=.56. Notably, all three subscales were significantly correlated with one another (p<.01), indicating that the RTCQ is not measuring three independent factors. Nonetheless, following standard practice, the

three unique underlying subscale factors (one corresponding to each subscale) of the RTCQ were evaluated, and verified, using confirmatory factor analysis. Reliability analysis of the three subscales resulted in Cronbach's alpha coefficients as follows: pre-contemplation, 0.67; contemplation, 0.83, and action, 0.84, thereby indicating sufficient internal consistency among items within each scale. When all items were treated as a single 12-item scale, the alpha coefficient was 0.72, with an average inter-item correlation of $r = .46$ (all $ps < .01$), clearly indicating that these items combine to form a homogenous scale.

The relationship between one's stage of change and drinking at 12-month follow-up was evaluated (See Table 1 for control variables of follow-up drinking behaviors). Stage of change did not predict alcohol consumption on any of the four measures of drinking at 12 months: 1) drinks per drinking day ($F_{(2,480)} = .13$, $p = .88$); 2) percent drinking days ($F_{(2,480)} = .69$, $p = .52$); 3) number of binge episodes ($F_{(2,480)} = .28$, $p = .39$); or 4) number of weeks exceeding sensible drinking limits ($F_{(2,480)} = .65$, $p = .27$). At baseline, those in the pre-contemplation stage (mean D/DD = 1.83; SD = 1.03), drank significantly less ($F_{(3,498)} = 24.41$, $p = .00$) than those in either the contemplation (mean D/DD = 2.68; SD = 1.23) and action (mean D/DD = 2.61: SD = 1.99) stages. Sixteen percent of the women assigned to the pre-contemplation stage drank than less than one drink per drinking day. 3. 3 b Readiness to Change as a Continuous Score As described previously, the three stages of change designations were converted to continuous scores for further analysis. The women's drinking goals were classified into one of four categories: 1) reduce drinking, 2) maintain current drinking (no change), 3) abstain from drinking, and 4) unknown, for the women who did not receive the brief intervention.

3. 3 c Mediators of RTC

Situational risk factors for drinking were obtained from the brief intervention summary completed after the enrollment interview. These "risk" variables were considered for mediation because heightened risk situations were thought to account for the variability in the predictive value of RTC scores. Seven risk situations were assessed (heightened risk for drinking when: bored, depressed, lonely, anxious, arguing, seeking fun, others are drinking) and tested as potential mediators of RTC.

First, regression analyses were run to examine whether participants' continuous RTC scores did in fact significantly predict follow up drinking behaviors. This effect was significant for the number of binge episodes, ($R^2 = .023$), $p = .00$, $b = .153$, number of weeks exceeding NIAAA sensible drinking limits, ($R^2 = .018$), $p = .00$, $b = .136$, and number of drinks per drinking day, ($R^2 = .038$), $p = .00$, $b = .194$, in the 6–12 months following study enrollment. These findings indicate that as continuous RTC scores moved towards action, certain drinking behaviors increased at follow-up. Continuous RTC scores did not significantly predict follow-up percentage of drinking days, ($R^2 = .001$), $p = .476$, $b = .033$, hence this dependent variable was excluded from further mediational analyses.

To test whether the path from the independent variable to the mediator was significant, subject's risky situations (or moods) for drinking were regressed onto continuous RTC scores, which revealed that "risk during argument," ($R^2 = .040$), $p = .00$, $b = .199$, and "risk when bored," ($R^2 = .023$), $p = .02$, $b = .150$, were significantly predicted by higher RTC scores (movement towards action orientation). To test whether the path from the mediator to the dependent variable was significant, follow up drinking was regressed on risky situations for drinking (controlling for RTC). This analysis revealed a significant effect, such that identifying arguments as a risky situation for drinking was associated with a greater number of weeks exceeding NIAAA sensible drinking limits, ($R^2 = .029$), $p = .01$, $b = .171$, and number of binge episodes, ($R^2 = .042$), $p = .00$, $b = .206$, at follow up. Similarly, identifying boredom as a risky situation for drinking lead to a greater number of weeks

exceeding NIAAA sensible drinking limits, ($R^2 = .039$), $p = .00$, $b = .197$, and number of binge episodes, ($R^2 = .051$), $p = .00$, $b = .225$ at follow up. The number of drinks per drinking day at follow up were not significantly related to being at increased risk for drinking due to argument ($R^2 = .002$), $p = .49$, $b = .045$, or boredom ($R^2 = .002$), $p = .30$, $b = .143$.

Next, both continuous RTC scores and the target risk situations for drinking were regressed on follow up drinking behaviors (i.e., controlling for continuous RTC in the mediation to outcome path). These analyses confirmed complete mediation, as the effect of RTC was attenuated when "risk during argument" ($R^2 = .038$, $p=.15$, $b = .095$, outcome variable = weeks exceeding drinking limits at follow-up; $R^2 = .059$, $p= .08$, $b = .116$, outcome variable = number of binges at follow-up) and "risk when bored" (outcome = weeks exceeding drinking limits at follow-up; $R^2 = .049$, $p=.13$, $b =.098$; outcome = number of binges at follow-up; $R^2 = .069$, $p=.06$, $b =.122$) were controlled for, but the effect of these risk factors on binges and exceeding drink limits remained significant (see Figure 2).

In addition, the role of alcohol craving was examined, as it was predicted that increased cravings, in the week before follow-up measurement was obtained, might reduce the predictive value of the RTCQ. Baron and Kenny's analytic procedures were followed. First, it was established that continuous RTC scores significantly predicted follow up binge episodes, drinks per drinking day, and number of weeks exceeding NIAAA sensible drinking limits. The percentage of days drinking at follow up was not significantly related to continuous RTC scores. Second, PAST week alcohol cravings were regressed onto continuous RTC scores, ($R^2 = .030$), $p = .00$, $b = .172$) Third, follow up drinking was regressed on weekly alcohol cravings. This analysis revealed a significant effect, such that higher PAST week alcohol cravings were associated with a greater number of weeks exceeding drinking limits, ($R^2 = .052$), $p = .00$, $b = .229$, and number of binge episodes, ($R^2 = .029$), $p = .00$, $b = .169$, at follow up (see Figure 3). Because the effect of RTC scores on follow-up drinking was not reduced to zero when controlling for PAST craving, partial mediation is indicated. PAST week alcohol cravings were not significantly associated with the number of drinks per drinking day ($R^2 = .008$), $p = .06$, $b = .090$, at follow up. Finally, these results including the simple direct effect on follow-up alcohol consumption could not be replicated with the NOW alcohol craving measures: drinks per drinking day ($R^2 = .005$), $p = .13$, $b = −.070$); percent drinking days ($R^2 = .007$), $p = .07$, $b = .083$); number of binge episodes ($R^2 = .000$), $p = .87$, $b = −.007$); or number of weeks exceeding sensible drinking limits ($R^2 = .000$), $p = .13$, $b = .068$).

3. 3 d Moderators of RTCQ

Drinks per drinking day at 12 month follow-up varied significantly by participants' medical condition ($R^2 =.044$, $p=.00$, $b = −.210$). Those with hypertension (mean=3.33, SD=.44) or diabetes (mean=2.31, SD=.29) drank more than those with either infertility (mean=1.72, SD=.27) or osteoporosis (mean=1.42, SD=.30). In order to determine if the effect of RTC on follow up drinking behaviors was moderated by participants' medical condition (hypertension, diabetes, infertility, or osteoporosis), an interaction term (continuous RTC X condition) was created, tested, and found to be significant (R^2 change = .02, $p = .00$, Cumulative $R^2 = .10$). Thus, the effect of (continuous) RTC on follow up drinks per drinking day was dependent on the medical condition for which participants were seeking treatment, ($R^2 = .034$, $p = .00$, $b = −.185$). These findings were replicated with the original stage of change (categorical) designations in a 4 (medical condition: diabetes, hypertension, infertility, or osteoporosis) X 3 (original categorical RTC designations: pre-contemplation, contemplation, action) ANOVA.

This analysis confirmed that the effect of RTC stages was significant, $F(3.490) = 6.395$, $p = .00$. Post-hoc analyses using the Scheffé post-hoc criterion for significance indicated that participants drank significantly more when they were contemplating a change to their drinking behaviors (M= 2.54, vs. pre-contemplative, M= 1.61, or action-oriented M= 2.11). Interestingly there was also a main effect for medical condition, $F(3.490) = 4.961$, $p = .002$, such that women with hypertension drank significantly more than those with other diseases (M= 3.33; vs. osteoporosis, M= 1.42; infertility, M = 1.72; or diabetes M= 2.31). Finally, the interaction, $F(9,474) = 2.343$, $p = .01$, revealed that those women with a diagnosis of hypertension drank the most when they were action-oriented for change (see Table 2 for a comparison of means). Thus, it appears that the RTCQ has reduced predictive value within this specific medical population.

4. 0 DISCUSSION

Stage of change designation did not predict drinking behavior in the 6 to 12 month period subsequent to enrollment in this study of 499 adult women. These women had medical problems potentially exacerbated by drinking, but who were not actively seeking alcohol treatment. The RTCQ failed to predict the expected changes in drinking outcomes. Stage of change designation, however, was significantly associated with drinks per drinking day at baseline, whereby those in the pre-contemplation stage (64 %) had the least drinks per drinking day, and those in the contemplation (12 %) and action (24%) stages drank more. These results support the conclusions of others, who have found that patients who drink more and have more severe alcohol related problems actually have more recognition or interest in changing their drinking behaviors (Williams et al., 2006).

Interestingly, when RTC scores were interpreted in a continuous fashion (Sutton, 1996), the measure significantly predicted drinking outcomes, such that as participants' motivation to change drinking behaviors increased (e.g., advanced from pre-contemplation to contemplation and action), their drinking also increased. This suggests that higher rates of drinking are associated with greater motivation to reduce drinking, in this non-treatment seeking, medically at-risk, sample. Moreover, these findings suggest that the traditional, stage-based, interpretation of the RTCQ may have less value in predicting motivation to change high-risk drinking. In light of these findings, it appears that readiness to change is a construct that requires further study. For instance, this "readiness" may be a reflection of the severity of one's drinking problem, the accumulated consequences that lead to change (e.g., increased awareness of the problematic nature of baseline drinking behaviors), or may indicate a shift in intentions to change. Hence, it remains unclear what mechanism drives the change process, and whether or not it truly occurs in a series of discrete changes, or as suggested by the current data, in a continuous fashion.

In addition, several preliminary findings about the mediators and moderators of RTCQ, when used as a continuous variable, were identified. For example, certain risk situations (during an argument or boredom) for drinking appeared to attenuate the association between an individual's readiness to change and later drinking behaviors. This finding is consistent with reported gender differences in motives for alcohol use, whereby women are more likely than men to drink alcohol in response to stress and negative emotions (Greenfield, Back, Lawson, & Brady, 2010). As such, women drinking in this context may experience diminished motivation to reduce drinking, regardless of their readiness to change. For example, it is possible that women who lack effective coping responses drink in response to stressful situations (e.g., argument) or unpleasant circumstances (e.g., boredom), so that even if their readiness to change is strong, their ability to change is greatly reduced by the lack of alternative coping skills. Hence, development of active, problem-focused coping

strategies instead of avoidant, emotion-focused coping (Folkman & Lazarus, 1980) may help such women reduce their alcohol use and may serve as the basis of future research efforts.

Past week craving for alcohol was significantly associated with a greater number of weeks exceeding drinking limits and number of binge episodes at follow up. Moreover, taking past weekly craving for alcohol into account improved the predictive value of the RTCQ. Past week craving for alcohol was measured using a simple Likert scale. Social desirability may be a possible explanation as to why reports of PAST week alcohol craving partially mediated the impact of RTC on future use, as compared to reports about current (NOW) craving, which did not. Some women may be reluctant or embarrassed to acknowledge current alcohol craving. Other studies have demonstrated that measures of craving can be a useful means of predicting drinking, although the standard interpretation of craving still needs to be conceptualized (Flannery, Poole, Gallop, & Volpicelli, 2003; Mezinskis, Honos-Webb, Kropp, & Somoza, 2001).

The association of RTC on later drinking was also moderated by the individual's medical condition, whereby women with diabetes or hypertension drank more than those with osteoporosis or infertility. A possible explanation may be that the delayed, adverse consequences of diabetes or hypertension moderate a woman's motivation, or possibly her perceptions of self-efficacy, to change her use of alcohol. Women with hypertension, in particular, appear to warrant special attention, because their readiness to change is inversely related to their drinking behavior. For these women, action-orientation to change was associated with greater follow-up drinking when as compared to all other study participants. The finding that medical conditions may moderate readiness to change problem drinking may be important as medical providers initiate screening and intervention efforts for their risky drinking patients. A "one size fits all" approach may not be helpful when the medical problems of women are considered.

For example, we observed that women with osteoporosis, infertility, and diabetes, all had the same pattern of drinking in relation to their RTC. Those in the contemplation stage drank significantly more than those in the pre-contemplation and action stages. In contrast, women with hypertension displayed a different pattern of drinking outcomes. For these hypertensive women, the action stage represented not only increased readiness to change, but perhaps also greater drinking risk, since hypertensive women in this stage also drank the most at follow up. Hypertensive women in the contemplation stage drank less than those in the action stage but more those in the pre-contemplation stage. This finding may have implications for understanding RTC, as well as for developing interventions that target problem-drinking women. Women, who are especially vulnerable to the negative medical consequences of alcohol, may experience an especially strong disparity between their motivation and ability to reduce drinking. This possible discrepancy may be an area for future research that could also examine factors that mediate the relationship between RTC and drinking outcomes among risk drinking women.

Potential limitations to study findings include reliance on self-reports of drinking measurement of stage of change, interpretation of meditational findings, and the conversion of the RTCQ to a continuous score. Participants may have provided inaccurate self-reports of consumption, or demonstrated reactivity to research protocols and regression to the mean (Clifford & Maisto, 2000; Cunningham, 2006; Finney, 2007). However, self-report methods of drinking have been the major source about human drinking behavior in most studies (Del Boca & Darkes, 2002). Ceiling effects for readiness to change may be associated with the self-reported levels of alcohol consumed by the women. In addition, the mediational findings should be interpreted with caution when we consider that the PAST craving measure was a self-report retrospective account collected in tandem with the NOW craving

assessment (during the 12-month follow-up). Moreover, there is some difficulty in interpreting the mediational findings because the same variable may serve as both a mediator and a moderator. For instance, risk situations for drinking might serve both roles. First, as a mediator, RTC might lead to higher drinking outcomes because it facilitates greater drinking during boredom and/or argument, which subsequently obstructs change. Second, as a moderator, RTC might be related to higher drinking outcomes especially for women who drink when bored and/or arguing because this tendency makes their readiness difficult to realize. Several assumptions underlie the demonstrated tests of mediation, including assumptions of the correct specification of causal ordering and causal direction. For these analyses, we assumed both temporal stability (since the value of an observation does not depend on when the treatment is delivered) and causal transience (since the effect of a treatment or of a prior measurement does not persist over time). Furthermore, the fact that the measurements were taken at times that reflect causal action (i.e., RTC was obtained prior to proposed mediators, which were measured before the follow-up drinking outcomes) provides additional support our mediational findings. Still, these interpretations are based primarily on non-statistical rationales because RTC was observed, rather than randomly assigned. As such, these preliminary findings may be temporally confounded, and should be interpreted with caution. Furthermore, information about drinking goals, risk situations for drinking, and behaviors to cope with drinking was collected only for the women receiving the brief intervention. Study participants may have been more motivated than average patients with similar health problems. Those with infertility may have become pregnant, and so, became abstinent for the sake of the fetus. Finally, stage of change was not measured at follow-up, so stage progression could not be ascertained.

These potential limitations notwithstanding, study results enhance our understanding of readiness to change. For example, possible mediators and moderators of change stage were identified, which may help to explain why RTC is not necessarily itself a mechanism of behavior change (Borsari, Murphy, & Carey, 2009). Past week craving for alcohol, or the risk of drinking during arguments or periods of boredom, as well a person's medical problems all appeared to be important factors influencing alcohol consumption in this sample of 499 women. Moreover, other study findings suggest that the RTCQ is not measuring discrete stages of change, and therefore converting RTCQ stages to continuous scores may increase the predictive value of the measure. It is also possible that behavior change itself is a continuous process, rather than a progression through discrete stages. Examining the relationship between a continuous model of readiness to change and existing models of behavior change (e.g., the Theory of Planned Behavior; Ajzen, 1985) may provide a greater understanding of those factors that determine motivation to change drinking behaviors. As the number of problem drinking women increases, it is desirable to identify the most effective means to modify their risk.

Acknowledgments

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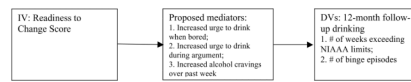
Figure 1.
Predicted mediators of Readiness to Change on drinking outcomes.
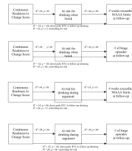
Figure 2.
Complete mediation of situational risk on the relationship between Readiness to Change and follow-up drinking outcomes.
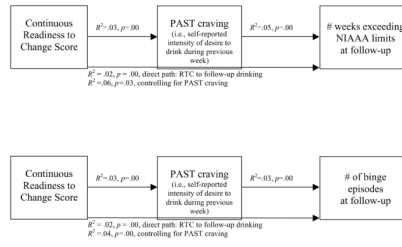
Figure 3.
Partial mediation of craving on the relationship between Readiness to Change and follow-up drinking outcomes.

Table 1

Regression Results for Alcohol Consumption at 12-month Follow-up

Predictors	D/DD		# of weeks exceeding limits		# of binge episodes		% of days drinking	
	b (SE)	p	b (SE)	p	b(SE)	p	b (SE)	p
Constant	1.49 (.44)	.00*	2.44 (1.77)	.17	4.76 (4.84)	.33	.16 (.07)	.01*
Stage of change (dummy coded categories)	.03 (.15)	.95	−.03 (.18)	.46	.031 (1.68)	.50	.06 (.02)	.17
Drinking goal of abstinence	−.21 (.16)	.18	−1.72 (.64)	.01*	−1.10 (1.75)	.53	−.10 (.02)	.00*
Risk of drinking when:								
Anxious	−.04 (.54)	.95	−2.43 (2.19)	.27	−8.05 (5.99)	.18	−.05 (.08)	.57
Others drinking	.11 (.29)	.64	.39 (1.00)	.70	.56 (2.73)	.84	−.03 (.04)	.47
Bored	.61 (.57)	.29	.20 (.29)	.00*	.22 (.28)	.00*	.06 (.088)	.52
Depressed	−.18 (.49)	.72	1.66 (1.97)	.40	−.19 (5.40)	.97	−.04 (.07)	.57
Lonely	1.10 (.89)	.22	6.29 (3.58)	.08	21.90 (9.81)	.067	.18 (.14)	.20
Arguing	−1.21 (.75)	.11	.17 (1.02)	.01*	.21 (8.28)	.00*	−.03 (.11)	.77
Want fun	−.19 (.25)	.45	−1.92 (1.02)	.06	−4.06 (2.81)	.149	−.10 (.04)	.01*
Cope with drink desire by:								
non-alcoholic drinks	−.32 (.26)	.21	−.49 (1.03)	.63	1.94 (2.82)	.49	−.04 (.04)	.28
Calling friend	.13 (.64)	.84	.36 (2.59)	.89	2.12 (7.09)	.77	−.04 (.10)	.67
Eating	.47 (.33)	.15	−2.21 (1.31)	.09	−2.97 (3.59)	.41	−.07 (.05)	.17
Exercising	.33 (.34)	.34	−.56 (1.38)	.69	1.21 (3.78)	.75	−.05 (.05)	.36
Watching TV	−1.81 (.91)	.05*	−2.07 (3.67)	.57	4.30 (10.05)	.67	−.19 (.14)	.17
Listening to music	−.19 (1.33)	.89	−.88 (5.35)	.87	−.92 (14.65)	.95	−.03 (.20)	.87
Lifetime abuse/Dependence on:								
Alcohol	.63 (.28)	.03*	2.26 (1.11)	.04*	5.30 (3.05)	.08	.02 (.04)	.71
Opiates	1.78 (.77)	.02*	−1.77 (3.08)	.57	−8.32 (8.44)	.32	.04 (.12)	.73
Marijuana	.77 (.40)	.06	.36 (1.63)	.83	−2.73 (4.46)	.54	.02 (.06)	.73
Cocaine	.97 (.54)	.07	−.81 (2.17)	.71	11.33 (5.93)	.06	−.02 (.08)	.76
Hallucinogens	−1.39 (.57)	.02*	−3.57 (2.30)	.12	−9.94 (6.31)	.12	−.10 (.09)	.27
NOW alcohol craving	.068 (.01)	.13	.06 (.04)	.12	.08 (.11)	.43	.00 (.00)	.25
PAST week alcohol craving	−.01 (.01)	.33	.23 (.03)	.00*	.17 (.07)	.00*	.00 (.00)	.14
Medical condition	−.21 (.07)	.00*	−.09 (.29)	.04*	−.16 (.66)	.00*	.06 (.01)	.15

Table 2

Mean Number of Drinks/Drink Day at follow up for RTCQ categories by Medical Condition Interaction

	RTCQ	Mean	StandardError	Mean difference (from Pre-contemplation w/in medical condition)	p	n	%
Medical Condition							
Hypertension	Pre-contemplation	1.67	.17			99	20
	Contemplation	2.76	.43	−1.09	.10	15	3
	Action	3.28	.25	−1.61	.00*	45	9
Diabetes	Pre-contemplation	2.16	.23			55	11
	Contemplation	3.15	.42	−.99	.04*	16	3
	Action	2.25	.38	−.09	.83	23	5
Infertility	Pre-contemplation	1.29	.17			105	21
	Contemplation	2.43	.39	−1.14	.00*	18	4
	Action **	1.40	.28	−.11	.57	37	7
Osteoporosis	Pre-contemplation	1.32	.22			61	12
	Contemplation	1.83	.49	−.51	.07	12	2
	Action	1.49	.51	−.17	.55	13	3

**

Note, of the participants with a diagnosis of infertility, those in who indicated they were in the action stage of change differed significantly from those in the contemplation stage of change (M difference = −1.02, p = .00*). None of the other post-hoc comparisons were significant.