



City Research Online

City St George's, University of London

Citation: Wittleder, S., Kappes, A., Oettingen, G., Gollwitzer, P. M., Jay, M. & Morgenstern, J. (2019). Mental Contrasting With Implementation Intentions Reduces Drinking When Drinking Is Hazardous: An Online Self-Regulation Intervention. *Health Education & Behavior*, 46(4), pp. 666-676. doi: 10.1177/1090198119826284

This is the accepted version of the paper.

This version of the publication may differ from the final published version. To cite this item please consult the publisher's version.

Permanent repository link: <https://openaccess.city.ac.uk/id/eprint/22343/>

Link to published version: <https://doi.org/10.1177/1090198119826284>

Copyright and Reuse: Copyright and Moral Rights remain with the author(s) and/or copyright holders. Copies of full items can be used for personal research or study, educational, or not-for-profit purposes without prior permission or charge, unless otherwise indicated, provided that the authors, title and full bibliographic details are credited, a hyperlink and/or URL is given for the original metadata page and the content is not changed in any way. For full details of reuse please refer to [City Research Online policy](#).

Mental Contrasting with Implementation Intentions (MCII) Reduces Drinking When
Drinking is Hazardous: An Online Self-Regulation Intervention

Sandra Wittleder¹, Andreas Kappes², Gabriele Oettingen^{1,3}, Peter M. Gollwitzer^{3,4},
Melanie Jay¹, and Jon Morgenstern⁵

¹NYU School of Medicine ²University of Oxford ³New York University ⁴University of
Konstanz ⁵Northwell Health

Author Note

Sandra Wittleder, Department of Internal Medicine and Clinical Innovation, New York University School of Medicine; Andreas Kappes, Department of Experimental Psychology, University of Oxford; Gabriele Oettingen, Psychology Department, New York University and Institute of Psychology, University of Hamburg; Peter M. Gollwitzer, Psychology Department, New York University and Department of Psychology, University of Konstanz; Melanie Jay, Departments of Medicine and Population Health, New York University School of Medicine; Jon Morgenstern, Center for Addiction Services and Psychotherapy Interventions Research, Northwell Health.

Correspondence concerning this article should be sent to Sandra Wittleder, Departments of Medicine and Population Health, New York University School of Medicine, 423 East 23rd Street, NY, NY, 10010. E-mail: sandra.wittleder@nyumc.org

Author Contributions

All authors developed the study hypotheses and contributed to the study design. S. Wittleder performed the data collection, analysis and interpretation under the supervision of A. Kappes, G. Oettingen, and P. M. Gollwitzer. S. Wittleder, A. Kappes, and G. Oettingen drafted the manuscript, and P. M. Gollwitzer, M. Jay, and J. Morgenstern provided critical revisions. All authors approved the final version of the paper for submission.

Abstract

Drinking alcohol has detrimental health consequences and effective interventions to reduce hazardous drinking are needed. The self-regulation intervention of Mental Contrasting with Implementation Intentions (MCII) promotes behavior change across a variety of health behaviors. In this study, we tested if online delivery of MCII reduced hazardous drinking in people who were worried about their drinking. **Method:** Participants ($N = 200$, female = 107) were recruited online. They were randomized to learn MCII or solve simple math problems (control). **Results:** Immediately after the intervention, participants in the MCII condition (vs. control) reported an increased commitment to reduce drinking. After one month, they reported having taken action measured by the Readiness to Change drinking scale (RTC). When drinking was hazardous ($AUDIT \geq 8$, $n = 85$), participants in the MCII condition indicated a decreased number of drinking days ($\exp(\beta) = 0.47$, CI [-1.322, -.207], $p = .02$) and drinks per week ($\exp(\beta) = 0.57$, CI [0.94, 5.514], $p = .007$) compared to the control condition. **Discussion:** These findings demonstrate that a brief, self-guided online intervention ($Mdn = 28$ minutes) can reduce drinking in people who worry about their drinking. Our findings show a higher impact in people at risk for hazardous drinking. **Conclusion:** MCII is scalable as an online intervention. Future studies should test the cost-effectiveness of the intervention in real-world settings.

Keywords: Mental Contrasting with Implementation Intentions (MCII), self-regulation, self-guided brief intervention, alcohol, computer-mediated health promotion

Excessive alcohol use is the third leading preventable cause of death in the United States (Stahre, Roeber, Kanny, Brewer, & Zhang, 2014) and has detrimental health consequences (National Institute on Alcohol Abuse and Alcoholism, 2000) that cost the United States billions of dollars each year (Sacks, Gonzales, Bouchery, Tomedi, & Brewer, 2010). Therefore, effective interventions to reduce hazardous drinking¹ are needed (World Health Organization, 2014); online interventions could save costs while increasing dissemination. Although they have promise as alternative treatments (Elliot, Carey, & Bolles, 2008; Riper et al., 2014; Rooke, Thorsteinsson, Karpin, Copeland, & Allsop, 2010), the evidence for the success of online interventions is still mixed (Bewick et al., 2008). The best framework for delivering online alcohol reduction interventions remains unknown (Balhara & Verma, 2014). Mental Contrasting with Implementation Intentions (MCII) (Oettingen, 2012, 2014; Oettingen & Gollwitzer, 2010) entails two complementary self-regulation strategies: Mental Contrasting (MC) and Implementation Intentions (II). Successful behavior change involves committing to goals, actively striving to reach them, and planning how to overcome potential obstacles to attaining those goals. MCII targets all of these tasks and thus promotes greater behavior change compared with the use of either strategy alone (Adriaanse et al., 2010; Kirk, Oettingen, & Gollwitzer, 2011), and is an auspicious strategy to reduce drinking.

Mental contrasting comprises three steps. People first name a desired and feasible future wish (e.g., becoming the person I was before I started drinking). Second, they identify the best outcome of fulfilling this wish and vividly imagine this best outcome (e.g., not being dependent, feeling energetic and accomplishing more tasks each day). Third, they identify a critical obstacle in themselves that stands in the way of realizing their wish and experiencing the best outcome; and then vividly imagine this inner obstacle (e.g., feeling pressured to drink by friends). Mental Contrasting helps people understand how to overcome their obstacle (e.g.,

saying no when feeling pressured to drink) and energizes people to commit to and actively strive for their desired future (Oettingen, 2012). Even though mental contrasting on its own promotes successful goal pursuit and behavior change, people may struggle – particularly if the obstacle is challenging, as is often the case when people try to change a bad habit (Adriaanse, Gollwitzer, De Ridder, de Wit, & Kroese, 2011; Webb & Sheeran, 2006).

Implementation intentions are if-then plans that help people to specify a goal-directed behavior in response to a critical situation (e.g., a good opportunity, a temptation, or a particular challenge or threat). In the framework of MCII, implementation intentions are geared towards overcoming difficult obstacles by forming an “if...obstacle, then I will.... behavior or thought to overcome obstacle” plan. For example, people might say to themselves: “If I feel pressured by my friends to order another drink, then I will tell them: Not today, maybe tomorrow!” Gollwitzer, 1993, 1999, 2014). Implementation intentions unfold their effects when goal commitment is high, the situation specified in the “if” part is critical for behavior change, and the behavior specified in the “then” part is instrumental to behavior change (Sheeran, Webb, & Gollwitzer, 2005). Mental Contrasting establishes all three prerequisites. It heightens goal commitment (Oettingen, 2012) and helps to identify inner obstacles that can be specified as the situational cue for the “if” part (Kappes, Wendt, Reinelt, & Oettingen, 2013). Mental Contrasting also helps to find a means to overcome these obstacles, which can consequently be specified in the “then” part (Kappes, Singmann, & Oettingen, 2012).

We and others have elucidated the mechanisms of MCII through experimental research. For instance, we discovered that changes in implicit cognition are critical mediators for the effects of mental contrasting as well as implementation intentions. After mental contrasting of feasible wishes, people interpret the current reality as a clear obstacle to behavior change (Kappes et al., 2013). Mental contrasting also strengthens the implicit

cognitive associations between the desired future and the obstacle of current reality (Kappes & Oettingen, 2014), as well as between these obstacles and instrumental means to overcome them (Kappes et al., 2012). These cognitive processes, outside of people's awareness, conjointly mediate changes in energization (Kappes & Oettingen, 2014; Oettingen et al., 2009), in commitment and performance (Kappes et al., 2012) as well as in the readiness to plan how to overcome the obstacles of the current reality (Kappes et al., 2013; Oettingen, Pak, & Schnetter, 2001).

Implementation Intentions increase the accessibility of the situational cue specified in the “if” part (Achtziger, Bayer, & Gollwitzer, 2012; Parks-Stamm, Gollwitzer, & Oettingen, 2007; Webb & Sheeran, 2007). Once this critical situation is encountered, they foster the automatic initiation of the goal-directed response specified in the “then” part (i.e., the specified response is executed fastly, efficiently, and no conscious intent is needed; Bayer, Achtziger, Gollwitzer, & Moskowitz, 2009; Brandstätter, Lengfelder, & Gollwitzer, 2001; Gollwitzer & Brandstätter, 1997; Miles & Proctor, 2008; Webb & Sheeran, 2007, 2008).

Past studies have demonstrated that MCII has promoted healthy behaviors such as regular exercise continued for over four months and following a healthy diet for up to two years (Stadler, Oettingen, & Gollwitzer, 2009, 2010). It has also promoted vigorous exercise and weight loss in stroke patients for over one year (Marquardt, Oettingen, Gollwitzer, Sheeran, & Liepert, 2017). Notably, MCII was particularly effective when behavior change was challenging rather than easy (Gollwitzer, 2014; Oettingen, 2012; Oettingen, Kappes, Guttenberg, & Gollwitzer, 2015). For example, MCII enhanced self-regulation for schoolchildren at risk for ADHD, thereby demonstrating its value for those who might need it the most (Gawrilow, Morgenroth, Schultz, Oettingen, & Gollwitzer, 2013).

For people who need help with an alcohol disorder or for those who are at risk, to date the US Community Preventive Service Task Force (2013) recommends the use of Screening,

Brief Intervention, and Referral to Treatment (SBIRT). Commonly SBIRT is delivered by a trained healthcare provider or other interventionist. There is evidence, however, that the SBIRT approach can also be extended to electronic screening and brief intervention (eSBI) (US Preventive Services Task Force, 2013).

One of the components of SBIRT is Motivational Interviewing (MI) (Miller & Rollnick, 1991). In MI, an interventionist utilizes a set of communication strategies (e.g., affirmations or reflective listening) to help people overcome their ambivalence and increase their motivation to change. Another intervention using MI is the national alcohol helpline in Sweden (Ahacic, Nederfeldt, & Helgason, 2014). It is a telephone-based intervention delivered by counselors who have received comprehensive training in MI and basic training in the use of elementary Cognitive Behavior Therapy (CBT) tools (e.g., positive reinforcement or gradual exposure) (Beck, 2011).

One common characteristic of MI, CBT and MCII is that they are highly individualized, and people can create their own specific goals. One main difference to MCII is that MI and CBT require conversation between two people—the patient/client and the interventionist. In contrast, MCII does not require any trained health professional or interventionist. Further, while MI and CBT approaches aim, for example, at eliciting change talk or increasing self-efficacy beliefs, MCII directly initiates behavior change through non-conscious cognitive mechanisms (e.g., a person forms strong automatic associations between their desired outcome and their personal obstacle). MCII entails a set order of 4 steps, which involve distinct goal-related concepts (i.e., wish, outcome, obstacle, plan). It assists people to identify a wish or desired future, identify and imagine the best outcome, identify and imagine the main inner obstacle, and finally formulate and imagine an if-then plan of how to overcome the obstacle. Patients can be taught to autonomously go through these 4 steps on

their own. This autonomy makes the procedure of MCII potentially highly scalable and accessible to the general population.

The present research explored the feasibility of online delivery of MCII and addressed the need for additional evidence to determine the best framework for alcohol consumption-related online interventions. We predicted that MCII would increase commitment to reduce one's drinking and it would increase readiness to take action, as measured by the Readiness to Change Drinking Scale (RTC), relative to a control condition. We also predicted that MCII would reduce drinking at a follow-up assessment. MCII should particularly help when behavior change was difficult (i.e., for people who reported hazardous drinking at baseline), relative to control participants. Finally, we also explored whether commitment to reduce drinking and taking action on the Readiness to Change drinking scale (RTC) mediate MCII effects.

Methods

Participants

We conducted a randomized controlled trial of online delivery of MCII vs. control in participants recruited online from the general community. Participants responded to the advertisement "Are you worried about your drinking? Is alcohol a problem for you?" posted via Amazon's MTurk website, a crowdsourcing Internet marketplace that researchers have utilized to recruit participants for online experiments (Buhrmester, Kwang, & Gosling, 2011). Participants had to be at least 18 years old, which is required in order to get access to Amazon's MTurk website. There was no additional screening. The Institutional Review Board of a large American University approved this study. Participants were asked to complete assessments at two time points, baseline, and one month later. In part one, we assessed baseline drinking behavior, delivered the MCII intervention or control, and assessed the dependent variables (e.g., motivation) as well as demographic information. Completing

the first part required about half an hour (*Mdn* = 28 minutes). Participants' MTurk worker IDs were collected for follow-up invitations and to link responses across time. We stored MTurk worker IDs separately to ensure anonymity. After one month, we re-assessed dependent variables (e.g., motivation and drinking outcomes). Compensation was \$3 for completing both portions of the study. Delivery of MCII vs. control and all data assessments were completed online using the Qualtrics online survey software. Participants were evenly randomized to one of the two groups using the survey flow randomization of the Qualtrics software. Participants were blind to condition throughout the study.

Intervention

MCII condition. The intervention was self-guided, and instructions were delivered online (details are provided in the supplemental materials). For all steps, participants typed their answers into the online survey. To familiarize themselves with MCII, participants started by identifying an important wish that pertained to any life domain and could be achieved in the next four weeks (e.g., finishing an application). Participants then identified the best outcome associated with realizing their wish (e.g., feeling free and satisfied). They were instructed to imagine this best outcome and write down all of their related thoughts. Thereafter participants identified the most important inner obstacle that prevents them from realizing their wish (e.g., getting distracted at night). They imagined this obstacle and wrote down all of the associated thoughts. Next, participants identified an action to overcome the inner obstacle and formed an implementation intention according to the following format: "If (here you name your obstacle), then I will (here you name your action)." Finally, participants reviewed the steps of MCII: (a) formulate a wish, (b) identify and imagine the best outcome, (c) identify and imagine the most important inner obstacle, and (d) formulate an if-then plan. They learned that people could use this strategy to realize their wishes (see Figure 1). Participants then applied the MCII exercise to reducing or stopping their drinking

(instructions delivered to participants online, see Appendix A). To demonstrate everyday applicability, participants finally performed an MCII exercise for a wish they wanted to realize within the next 24 hours (Stadler et al., 2009, 2010; Oettingen, 2014), one that could pertain to alcohol or any other wish or goal.

Control condition. Participants in the control condition read a cover story stating that realizing wishes is related to the ability to focus attention. To help train this ability, they solved 19 arithmetic problems modified from the “Concentration Achievement Test” (Düker & Lienert, 1965). For each of these problems, participants first solved two mathematical equations (e.g., 7-3 and 4+5), remembered the results, subtracted the lower number from the higher number, and entered the answer. This light placebo intervention required intense concentration and therefore prevented participants from spontaneously using self-regulation strategies.

Measures

Commitment to reduce drinking. Participants indicated their commitment to reduce or stop drinking immediately after the intervention at baseline (8 items; $\alpha = .98$; e.g., How committed are you to reduce or stop drinking?) on a scale from 1 (*Not at all*) to 7 (*Very*) (Oettingen et al., 2009).

Readiness to change drinking. Participants completed the Readiness to Change Drinking Scale (RTC; Rollnick, Heather, Gold, & Hall, 1992) twice. The first time was immediately after the intervention at baseline and the second time was at the 1-month follow up. RTC comprises three stages: precontemplation, contemplation, and action (the most advanced stage). Answers were combined for each of the three stages (4 items each) at both time points ($\alpha s = .78$ to $.89$).

Drinking outcomes. At baseline and the 1-month follow-up, we administered the Alcohol Timeline Follow-Back Method (TLFB; Sobell & Sobell, 1992), referencing the past

14 days. The TLFB shows psychometrically sound properties when administered online (Pedersen, Grow, Duncan, Neighbors, & Larimer, 2012). Participants retrospectively reported their drinking events and the number of standard drinks consumed for each day. The number of drinking days per week served as a measure of frequency and the number of drinks per week as a measure of quantity². To assess drinking-related problems, participants completed the Alcohol Problems Questionnaire (APQ; Williams & Drummond, 1994) at both the baseline ($\alpha = .88$) and the 1-month follow-up ($\alpha = .80$), again referencing the past 14 days.

Perceived change. At the end of the 1-month follow-up, participants indicated how much their alcohol consumption had changed (i.e., To what extent do you feel that your alcohol consumption changed over the past 4 weeks?) and how much their everyday life had changed (i.e., To what extent do you feel that your everyday life changed over the past 4 weeks?) on a scale from 1 (*Not at all*) to 7 (*Very*).

Moderator variable: Hazardous drinking. Before the intervention, participants completed the Alcohol Use Disorders Identification Test (AUDIT; Babor, Higgins-Biddle, Saunders, & Monteiro, 2001). Scores of 8 and higher indicated hazardous alcohol use ($\alpha = .88$)³.

Data Analytic Plan

Analyses were performed using SPSS. A p value $<.05$ was regarded as statistically significant, two-tailed. To explore differences between completers and non-completers and baseline differences between intervention and control participants, we performed a series of univariate ANOVAs and χ^2 tests. To examine differences in commitment, readiness to change and perceived change between conditions, we performed univariate ANOVAs. To test whether MCII reduces drinking particularly for people experiencing hazardous drinking, we used the Generalized Estimating Equation (GEE) approach (Liang & Zeger, 1986). The GEE approach can be used to model non-normally distributed variables (e.g., count variables). The

drinking indicators were drinking days, drinks per week, and alcohol-related problems. These variables were not normally distributed and displayed overdispersion. Therefore, we used negative binominal GEE models. We re-coded AUDIT scores into a dichotomous variable, with 1 coding non-hazardous drinking ($AUDIT < 8$) and 0 coding hazardous drinking ($AUDIT \geq 8$). The MCII condition was coded as 0 and the control condition was coded as 1. A series of 2 x 2 negative binominal GEE models with Condition (MCII vs. control), and AUDIT (non-hazardous vs. hazardous) were used to compare MCII effects for non-hazardous and hazardous drinkers. Baseline levels of each drinking indicator were covariates. Before analyses, we corrected outliers by changing values greater than or equal to 3.29 standard deviations above the mean to be one unit greater than the greatest non-outlier value (Tabachnick & Fidell, 2012). To test our mediation hypothesis, we computed a composite score of frequency and quantity of alcohol consumption and performed serial multiple mediator analyses using ordinary least squares path analysis (Model 6 in the PROCESS macro; Hayes, 2013).

Results

Sample

A total of 366 participants were randomly assigned to the MCII condition ($n = 183$) or the control condition ($n = 183$). Out of these participants, 131 participants (35.79%) did not respond to 1-month follow-up invitations and 35 participants (10.02%) had incomplete data⁴. For detailed participant flow see Figure 2. Attrition was not significantly different across conditions, $\chi^2(1, N = 131) = 1.72, p = .19$. Completers vs. non-completers did not significantly differ in gender, $\chi^2(1, N = 328) = 3.18, p = .08$, AUDIT, APQ baseline, age, income, or education, $F_{\text{Sunivariate}}(1,252) = .002$ to $3.20, ps > .07, \eta_p^2s < .02$.

The final sample of $N = 200$ (MCII = 92; control = 108) consisted of 107 females (53.5%). Age varied between 20 and 67 years ($M = 35.0, SD = 12.0$). The sample was 87.0%

Caucasian. Table 1 represents participants' demographics. Drinking was hazardous for 85 participants (42.5%) using the cut-off point of 8 on the AUDIT ($M = 8.15$, $SD = 6.93$) (Babor et al., 2001). Participants experienced an average of 4 out of 23 alcohol-related problems within the past two weeks (APQ: $M = 3.83$, $SD = 4.09$). Table 2 shows means, standard deviations, and correlations for baseline measures. Conditions did not significantly differ in gender, $\chi^2(1, N = 200) = .26$, $p = .61$, AUDIT, APQ baseline, age, income, or education, $F_{\text{Sunivariate}}(1,184) = .02$ to 1.39 , $ps > .23$, $\eta_p^2s < .009$.

Commitment

MCII increased commitment to reduce drinking. Results of a univariate ANOVA showed that participants in the MCII condition reported stronger commitment to reduce or stop drinking ($M = 3.70$, $SD = 1.94$) than the control condition ($M = 2.99$, $SD = 2.06$), $F(1,198) = 6.35$, $p = .02$, $\eta_p^2 = .03$.

Readiness to Change (RTC)

After four weeks, participants reported to have taken more action towards changing their drinking in the MCII ($M = .11$, $SD = 1.08$) than in the control group ($M = -.27$, $SD = 1.02$). Condition had a significant effect on the action score (e.g., "I am actually changing my drinking habits right now"), $F(1,198) = 6.42$, $p = .01$, $\eta_p^2 = .03$. There was no significant effect of Condition on the precontemplation or the contemplation score, $F_{\text{Sunivariate}}(1,198) = .62$ to 3.37 , $ps > .06$, $\eta_p^2s < .02$. Similarly, there was also no significant effect of Condition on the RTC stages (i.e., precontemplation, contemplation, and action) when RTC was measured directly after the manipulation, $F_{\text{Sunivariate}}(1,193) = 1.02$ to 1.51 , $ps > .21$, $\eta_p^2s < .009$.

Drinking Behavior

Based on past research demonstrating that MCII is particularly effective when behavior change is challenging (Gollwitzer, 2014; Oettingen, 2012), we expected that MCII would have the strongest effects when drinking was hazardous. In line with this hypothesis,

we observed the predicted interaction effects of Condition by AUDIT on drinking days per week (frequency), $\exp(\beta) = 0.57$, 95% CI [0.94, 5.514], $p < .001$, and drinks per week (quantity), $\exp(\beta) = 0.47$, 95% CI [-1.322, -.207], $p = .007$. For the group of participants who reported hazardous drinking at baseline (i.e., AUDIT ≥ 8), participants in the MCII condition were 43% less likely to report drinking days at 1-month follow-up than the control condition, and 53% less likely to report drinks consumed at follow-up than the control condition. Moreover, when drinking was hazardous, participants in the MCII condition decreased their alcohol consumption from baseline to follow-up by 37% ($M = 1.21$) for drinking days, and by 55% ($M = 9.98$) for drinks per week. Figure 3 depicts mean changes in drinking days and drinks per week by Condition and AUDIT.

In contrast, for drinking-related problems, GEE analyses revealed no significant interaction effect, $p = .48$, of Condition and AUDIT. Table 3 contains means and standard deviations at baseline and 1-month follow-up by Condition and AUDIT for drinking days, drinks per week, and drinking-related problems.

MCII Affects Drinking Reduction via Commitment and Readiness to Change

Serial multiple mediation analyses adjusting for baseline drinking revealed that condition indirectly influenced follow-up drinking ($adb = -.023$; 95% CI [-.055, -.001]) through its effect on commitment and action score (RTC). Participants in the MCII condition (versus the control condition) heightened commitment to reduce or stop drinking, which in turn predicted increased reported action on the RTC scale, which finally predicted reduced drinking at follow-up.

Perceived Change

MCII increased perceived change in alcohol consumption. Results of a univariate ANOVA showed that participants in the MCII condition perceived more change ($M = 3.41$, $SD = 2.16$) than the control condition ($M = 2.50$, $SD = 1.90$), $F(1,198) = 10.11$, $p = .002$, η_p^2

= .05. MCII also helped to change their everyday life. Results of a univariate ANOVA showed that participants in the MCII condition reported higher perceived change in life ($M = 3.10$, $SD = 2.13$) than the control condition ($M = 2.52$, $SD = 1.98$), $F(1,198) = 3.92$, $p < .05$, $\eta_p^2 = .02$.

Discussion

We examined MCII as a brief online intervention to help people recruited online who wished to reduce their drinking. In line with previous research on MCII benefitting various indicators of health behavior (Oettingen & Gollwitzer, 2018), our participants benefitted from MCII more compared to the control condition. We found that MCII immediately boosted commitment to reduce drinking and one month later fostered taking action to change drinking. Our finding that MCII only affected the action score of the Readiness to Change Scale, rather than the precontemplation and contemplation scores, suggests that (a) we were successful in recruiting participants who indeed wanted to reduce or stop their drinking, and (b) participants in the MCII condition took action to reduce their drinking over the course of that month. Importantly, participants whose drinking was hazardous (i.e., AUDIT ≥ 8) and who were in the MCII condition reported drinking less one month after the intervention than respective participants in the control condition.

There are several limitations to our study. First, even though we recruited people who worried about their drinking, we did not pre-screen study participants for hazardous drinking. Still, more than 40% of the sample met the hazardous drinking threshold (i.e., AUDIT ≥ 8). Moderation analyses indicated that MCII was especially valuable for these drinkers. Future research should determine whether the present results replicate in a sample of even more hazardous drinkers than the ones in the present sample. Second, we found that MCII did not reduce alcohol-related problems (i.e., APQ scale). This finding might have been due to a floor effect. As the present sample was not pre-selected for hazardous drinking, people

reported a low number of alcohol-related problems at baseline ($M = 3.87$, $SD = 4.26$). Third, our measures relied on participants' self-reported answers. Future studies should replicate the present findings utilizing more objective measures of alcohol consumption. Fourth, we only had a brief follow-up period of one month – thus efficacy of MCII on long-term drinking reduction still needs to be established. Finally, even though our dropout rate of 35.79% is common for studies on MTurk, it is high compared to retention observed in clinical trials. Moreover, although our analyses indicate that attrition was not dependent on condition, there is still a possibility that certain participants (e.g., more conscientious individuals) may have been more likely to respond to follow-up invitations than others (Zhou & Fishbach, 2016).

Given the majority of our sample identified as Caucasian, future studies need to confirm the applicability to the general population. Furthermore, elaborating on wishes to reduce drinking in the MCII condition might have enhanced social desirability to report success. However, we advertised the control condition as an exercise to help to reach personal goals; this should have spurred similar feelings of social desirability. Still, MCII produced its beneficial effects on drinking reduction as compared to the control group. Also, various studies found that enhanced social desirability could not explain MCII effects (Christiansen, Oettingen, Dahme, & Klinger, 2010; Stadler et al., 2009, 2010).

Despite these limitations, benefits of MCII include its easy-to-learn structure and timesaving use. It can be self-administered without the help of a coach or therapist. These attributes are in contrast to other interventions such as MI (Miller & Rollnick, 1991), CBT (Beck, 2011), or providing normative feedback (Walters & Neighbors, 2005), which requires gathering individual behavior and comparing it to relevant norms. Furthermore, many hazardous drinkers shy away from seeking professional help and prefer online self-help outside of conventional settings (Cunningham & Breslin, 2004; Cunningham & van Mierlo,

2009; Koski-Janne & Cunningham, 2001). MCII is auspicious, as it might reach drinkers who otherwise would not seek treatment.

In conclusion, a brief self-guided online MCII intervention (*Mdn* = 28 minutes) reduced drinking in an online community sample of Amazon's MTurk website users for persons at risk for hazardous drinking. MCII, therefore, has promise to help those who want to reduce their hazardous drinking. Future studies should test the cost-effectiveness of the online intervention in real-world settings.

References

- Achtziger, A., Bayer, U. C., & Gollwitzer, P. M. (2012). Committing to implementation intentions: Attention and memory effects for selected situational cues. *Motivation & Emotion*, 36, 287–303.
- Adriaanse, M. A., Oettingen, G., Gollwitzer, P. M., Hennes, E. P., De Ridder, D. T. D., & De Wit, J. B. F. (2010). When planning is not enough: Fighting unhealthy snacking habits by mental contrasting with implementation intentions (MCII). *European Journal of Social Psychology*, 40, 1277–1293.
- Adriaanse, M. A., Gollwitzer, P. M., de Ridder, D. T. D., de Wit, J. B. F., & Kroese, F. M. (2011). Breaking habits with implementation intentions: A test of underlying processes. *Personality and Social Psychology Bulletin*, 37, 502–512.
- Ahacic. K., Nederfeldt, L., & Helgason, A. R. (2014). The national alcohol helpline in Sweden: an evaluation of its first year. *Substance Abuse Treatment, Prevention, and Policy*, 9: 28.
- Babor, T. F., Higgins-Biddle, J. C., Saunders, J. B., & Monteiro, M. G. (2001). *AUDIT - The Alcohol Use Disorders Identification Test: Guidelines for use in primary care*. World Health Organization Department of Mental Health and Substance Dependence, Geneva.
- Balhara, Y. & Verma, R. (2014). A review of web based interventions focusing on alcohol use. *Annals of Medical and Health Sciences Research*, 4, 472–480.
- Bayer, U. C., Achtziger, A., Gollwitzer, P. M. & Moskowitz, G. (2009). Responding to subliminal cues: Do if-then plans facilitate action preparation and initiation without conscious intent? *Social Cognition*, 27, 183–201.
- Beck, J. S. (2011). *Cognitive behavior therapy: Basics and beyond*. New York: Guilford Press.

- Bewick, B. M., Trusler, K., Barkham, M., Hill, A. J., Cahill, J., & Mulhern, B. (2008). The effectiveness of web-based interventions designed to decrease alcohol consumption—A systematic review. *Preventive Medicine, 47*, 17–26.
- Brandstaetter, V., Lengfelder, A., & Gollwitzer, P. M. (2001). Implementation intentions and efficient action initiation. *Journal of Personality and Social Psychology, 81*, 946–960.
- Buhrmester, M., Kwang, T., & Gosling, S. (2011). Amazon's Mechanical Turk: A new source of inexpensive, yet high-quality, data? *Perspectives on Psychological Science, 6*, 3–5.
- Christiansen, S., Oettingen, G., Dahme, B., & Klinger, R. (2010). A short goal-pursuit intervention to improve physical capacity: A randomized clinical trial in chronic back pain patients. *Pain, 149*, 444–452.
- Cunningham, J. A., & Breslin, F. C. (2004). Only one in three people with alcohol abuse or dependence ever seek treatment. *Addictive Behaviors, 29*, 221–223.
- Cunningham, J. A., & van Mierlo, T. (2009). Methodological issues of Internet-based interventions for problem drinking. *Drug and Alcohol Review, 28*, 12–17.
- Düker, H., & Lienert, G. A. (1965). *Konzentrations-Leistungs-Test : K-L-T Handanweisung für die Durchführung und Auswertung*. Göttingen: Verlag für Psychologie, Hogrefe.
- Edwards, G., Arif, A., & Hodgson, R. (1981). Nomenclature and classification of drug and alcoholrelated problems: a WHO memorandum. *Bulletin of the World Health Organization, 59*, 225–242.
- Elliot, J. C., Carey, K. B., & Bolles, J. R. (2008). Computer-based interventions for college drinking: a qualitative review. *Addictive Behaviors, 33*, 994–1005.
- Fishbein, M., & Ajzen, I. (2009). *Predicting and changing behavior: The reasoned action approach*. New York: Psychology Press.

Gawrilow, C., Morgenroth, K., Schultz, R., Oettingen, G., & Gollwitzer, P. M. (2013).

Mental contrasting with implementation intentions enhances self-regulation of goal pursuit in schoolchildren at risk for ADHD. *Motivation and Emotion*, 37, 134–145.

Gollwitzer, P. M. (1990). Action phases and mind-sets. In E. T. Higgins & R. M. Sorrentino (Eds.), *The handbook of motivation and cognition: Foundations of social behavior* (Vol. 2, pp. 53–92). New York: Guilford Press.

Gollwitzer, P. M. (1993). Goal achievement: The role of intentions. *European Review of Social Psychology*, 4, 141–185.

Gollwitzer, P. M. (1999). Implementation intentions: Strong effects of simple plans. *American Psychologist*, 54, 493–503.

Gollwitzer, P. M. (2014). Weakness of the will: Is a quick fix possible? *Motivation and Emotion*, 38, 305–322.

Gollwitzer, P. M., & Brandstaetter, V. (1997). Implementation intentions and effective goal pursuit. *Journal of Personality and Social Psychology*, 73, 186–199.

Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. New York: Guilford Press.

Kappes, A., & Oettingen, G. (2014). The emergence of goal pursuit: Mental contrasting connects future and reality. *Journal of Experimental Social Psychology*, 54, 25–39.

Kappes, A., Singmann, H., & Oettingen, G. (2012). Mental contrasting instigates goal pursuit by linking obstacles of reality with instrumental behavior. *Journal of Experimental Social Psychology*, 48, 811–818.

Kappes, A., Wendt, M., Reinelt, T., & Oettingen, G. (2013). Mental contrasting changes the meaning of reality. *Journal of Experimental Social Psychology*, 49, 797–810.

Kirk, D., Oettingen, G., & Gollwitzer, P. M. (2011). Mental contrasting promotes integrative bargaining. *International Journal of Conflict Management*, 22, 324–341.

- Koski-Janne, A., & Cunningham, J. A. (2001). Interest in different forms of self-help in a general population sample of drinkers. *Addictive Behaviors*, 26, 91–99.
- Liang, K.-Y., & Zeger, S. L. (1986). Longitudinal data analysis using generalized linear models. *Biometrika*, 73, 13–22.
- Marquardt, M. K., Oettingen, G., Gollwitzer, P. M., Sheeran, P., & Liepert, J. (2017). Mental contrasting with implementation intentions (MCII) improves physical activity and weight loss among stroke patients over one year. *Rehabilitation Psychology*.
- Miles, J. D., & Proctor, R.W. (2008). Improving performance through implementation intentions: Are preexisting response biases replaced? *Psychonomic Bulletin & Review* 15, 1105–1110.
- Miller, W. R., & Rollnick, S. (1991). *Motivational interviewing: Preparing people to change addictive behavior*. New York: Guilford Press.
- National Institute on Alcohol Abuse and Alcoholism (2000). *10th special report to the U.S. Congress on alcohol and health: Highlights from current research from the Secretary of Health and Human Services*. U.S. Department of Health and Human Services.
- Oettingen, G. (2000). Expectancy effects on behavior depend on self-regulatory thought. *Social Cognition*, 18, 101–129.
- Oettingen, G. (2012). Future thought and behavior change. *European Review of Social Psychology*, 23, 1–63.
- Oettingen, G. (2014). *Rethinking positive thinking: inside the new science of motivation*. New York, NY: Penguin Random House.
- Oettingen, G., Kappes, H. B., Guttentag, K. B., & Gollwitzer, P. M. (2015). Self-regulation of time management: Mental contrasting with implementation intentions. *European Journal of Social Psychology*, 45, 218–229.

- Oettingen, G., Mayer, D., Sevincer, T. A., Stephens, E. J., Pak, H.-J., & Hagenah, M. (2009). Mental contrasting and goal commitment: The mediating role of energization. *Personality and Social Psychology Bulletin*, 35, 608–622.
- Oettingen, G., & Gollwitzer, P. M. (2010). Strategies of setting and implementing goals: Mental contrasting and implementation intentions. In J. E. Maddux & J. P. Tangney (Eds.), *Social psychological foundations of clinical psychology* (pp. 114–135). New York: The Guilford Press.
- Oettingen, G., & Gollwitzer, P. M. (2018). Health behavior change by self-regulation of goal pursuit. In D. de Ridder, M. Adriaanse, & K. Fujita (Eds.), *The Routledge international handbook of self-control in health and well-being* (pp. 418-430). New York: Routledge.
- Oettingen, G., Pak, H., & Schnetter, K. (2001). Self-regulation of goal setting: Turning free fantasies about the future into binding goals. *Journal of Personality and Social Psychology*, 80, 736-753.
- Parks–Stamm, E. J., Gollwitzer, P. M., & Oettingen, G. (2007). Action control by implementation intentions: Effective cue detection and efficient response initiation. *Social Cognition*, 25, 248–266.
- Pedersen, E. R., Grow, J., Duncan, S., Neighbors, C., & Larimer, M. E. (2012). Concurrent validity of an online version of the timeline followback assessment. *Psychology of Addictive Behaviors*, 26, 672–677.
- Riper, H., Blankers, M., Hadiwijaya, H., Cunningham, J. A., Clarke, S., Wiers, R., Ebert, D., & Cuijpers, P. (2014). Effectiveness of guided and unguided low-intensity internet interventions for adult alcohol misuse: A meta-analysis. *Public Library of Science ONE*, 9, e99912.

- Rollnick, S., Heather, N., Gold, R., & Hall, W. (1992). Development of a short “readiness to change” questionnaire for use in brief, opportunistic interventions among excessive drinkers. *British Journal of Addiction*, 87, 743–754.
- Rooke, S., Thorsteinsson, E., Karpin, A., Copeland, J., & Allsop, D. (2010). Computer-delivered interventions for alcohol and tobacco use: A meta-analysis. *Addiction*, 105, 1–10.
- Sacks, J. J., Gonzales, K. R., Bouchery, E. E., Tomedi, L. E., & Brewer, R. D. (2010). 2010 national and state costs of excessive alcohol consumption. *American Journal of Preventive Medicine*, 49, e73–e79.
- Sheeran, P., Webb, T. L., & Gollwitzer, P. M. (2005). The interplay between goal intentions and implementation intentions. *Personality and Social Psychology Bulletin*, 31, 87–98.
- Sobell, L., & Sobell, M. (1992). Timeline follow-back: A technique for assessing self-reported alcohol consumption. In J. Allen & R. Z. Litten (Eds.). *Measuring alcohol consumption psychosocial and biochemical methods* (pp. 41–72). Totowa, NJ: Humana Press.
- Stadler, G., Oettingen, G., & Gollwitzer, P. M. (2009). Physical activity in women. *American Journal of Preventive Medicine*, 36, 29–34.
- Stadler, G., Oettingen, G., & Gollwitzer, P. M. (2010). Intervention effects of information and self-regulation on eating fruits and vegetables over two years. *Health Psychology*, 29, 274–283.
- Stahre, M., Roeber, J., Kanny, D., Brewer, R. D., & Zhang, X. (2014). Contribution of excessive alcohol consumption to deaths and years of potential life lost in the United States. *Preventing Chronic Disease*, 11, E109.
- Tabachnick, B. G., & Fidell, L. S. (2012). *Using multivariate statistics*. Boston, MA: Pearson Education.

- US Preventive Services Task Force (2013). Screening and behavioral counseling interventions in primary care to reduce alcohol misuse: U.S. Preventive Services Task Force recommendation statement *Annals of Internal Medicine*, 159, 210–218.
- Walters, S. T., & Neighbors, C. (2005). Feedback interventions for college alcohol misuse: What, why and for whom? *Addictive Behaviors*, 30, 1168–1182.
- Webb, T. L., and Sheeran, P. (2006). Does changing behavioral intentions engender behavior change? A meta-analysis of the experimental evidence, *Psychological Bulletin*, 132, 249–68.
- Webb, T. L., and Sheeran, P. (2007). How do implementation intentions promote goal attainment? A test of component processes, *Journal of Experimental Social Psychology*, 43, 295–302.
- Webb, T.L., and Sheeran, P. (2008) Mechanisms of implementation intention effects: the role of goal intentions, self-efficacy, and accessibility of plan components. *British Journal of Social Psychology*, 47, 373–95.
- Williams, B. T. R., & Drummond, C. D. (1994). The Alcohol Problems Questionnaire: Reliability and validity. *Drug and Alcohol Dependence*, 35, 239–243.
- World Health Organization (2014). *Global status report on noncommunicable diseases 2014*. Geneva, Switzerland: WHO Press.
- Zhou, H., & Fishbach, A. (2016). The pitfall of experimenting on the web: How unattended selective attrition leads to surprising (yet false) research conclusions. *Journal of Personality and Social Psychology*, 111, 493–504.

Footnotes

¹In WHO terminology hazardous drinking confers the risk of physical and/or psychological harm (Edwards, Arif, & Hodgson, 1981).

² If participants had missing responses for more than two days, drinking indicators were not calculated.

³ Additional covariates were incentive, short and long-term expectations, normative beliefs, perceived control, with respect to reduced drinking (see Fishbein & Ajzen, 2009). Completers vs. non-completers and conditions did not differ on these measures.

⁴ Inclusion versus exclusion of participants with incomplete data did not affect the significance levels of results.

⁵ The drinking indicators were correlated at $r = .74$, and thus we included a Bonferroni adjustment ($p = .025$).

Table 1

Demographics of Participants

Demographics	Control (n = 108)	MCII (n = 92)
Gender		
Female	56 (52%)	51(55%)
Male	52 (48%)	41 (45%)
Annual household income		
No income	6 (6%)	2 (2%)
< 5 K	4 (4%)	9 (10%)
5,000 – 11,999	9 (8%)	3 (3%)
12,000 – 19,999	4 (4%)	7 (8%)
20,000 – 39,999	33 (31%)	31 (34%)
40,000 – 59,999	14 (13%)	18 (20%)
60,000 – 79,999	9 (8%)	10 (11%)
> 80 K	24 (22%)	10 (11%)
Education		
Less than high school	2 (2%)	1 (1%)
High school diploma or GED	10 (11%)	9 (10%)
Some college	36 (33%)	31 (34%)
College degree	32 (30%)	20 (22%)
Associates degree	2 (2%)	12 (13%)
Some graduate or professional training	5 (5%)	6 (7%)
Graduate or professional degree	17 (16%)	12 (13%)
Employment status		
Disabled	-	2 (2%)
Homemaker	16(15%)	2 (2%)
Retired	-	2 (2%)
Self-employed	3 (3%)	11 (12%)
Student	11 (10%)	11 (12%)
Unemployed not seeking work	13 (12%)	2 (2%)
Unemployed seeking work	7 (6%)	9 (10%)
Working part time	10 (11%)	5 (5%)
Working full-time > 35h/w	44 (41%)	47 (51%)
Race		
African American, Black, of African descent	4 (4%)	5 (5%)
American Indian (Native American)	1 (1%)	1 (1%)
Asian/Pacific Islander	6 (6%)	5 (5%)
Hispanic/Latino	3 (3%)	6 (7%)
White, Caucasian, European descent	94 (87%)	80 (87%)
Other/Unknown	-	-
Hazardous drinking		
AUDIT < 8	67 (62%)	48 (52%)
AUDIT ≥ 8	41 (38%)	44 (48%)

Note. Multiple answers were possible for race.

Table 2

Means, Standard Deviations, and Correlations for Baseline Measures

Measure	<i>M (SD)</i>	1	2	3	4	5	6
1. AUDIT	8.17 (6.94)	-					
2. APQ	3.87 (4.26)	.69**	-				
3. Drinking days per week	2.81 (2.02)	.41**	.27**	-			
4. Drinks per week	3.54 (3.19)	.67*	.48**	.74**		-	
5. Age	35.08 (12.0)	-.15*	-.13	.01	-.09		-
6. Income	5.35 (1.90)	-.16*	-.15*	.01	-.09	.13	
7. Education	5.04 (1.62)	-.08	-.08	.10	.01	.02	.31*

Note. AUDIT = Alcohol Use Disorder Identification Test; APQ = Alcohol Problems Questionnaire.

* $p < .05$, ** $p < .001$

Table 3

Means for Drinking Days per Week, Drinks per Week, and Drinking-Related Problems at Baseline and Follow-up by Condition and Hazardous Drinking (i.e., AUDIT)

Hazardous Drinking	Control		MCII	
	Baseline <i>M(SD)</i>	Follow-up <i>M(SD)</i>	Baseline <i>M(SD)</i>	Follow-up <i>M(SD)</i>
Drinking days per weeks				
AUDIT <8	2.11(1.84)	2.02(1.76)	2.48(1.88)	2.23(2.20)
AUDIT ≥8	3.79(1.97)	3.31(1.99)	3.28(2.05)	2.07(1.89)
Drinks per week				
AUDIT <8	5.30(5.59)	5.96(6.25)	6.02(5.01)	5.65(6.74)
AUDIT ≥8	21.39(16.43)	17.76(15.09)	17.81(13.00)	7.83(7.14)
Drinking-related problems				
AUDIT <8	1.96(2.46)	1.91(2.13)	2.13(2.13)	1.96(2.05)
AUDIT ≥8	7.13(4.42)	4.00(3.19)	5.57(4.85)	3.21(3.36)

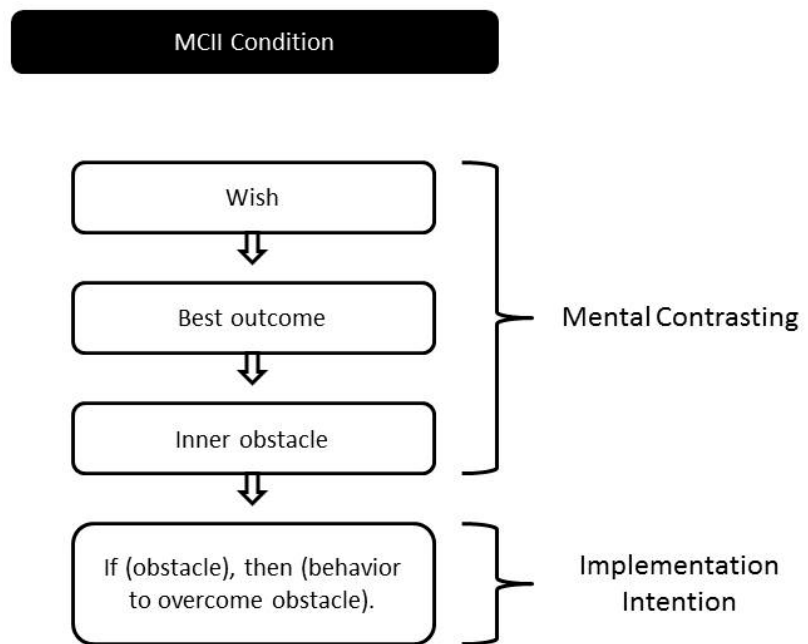


Figure 1. Overview of the steps in MCII.

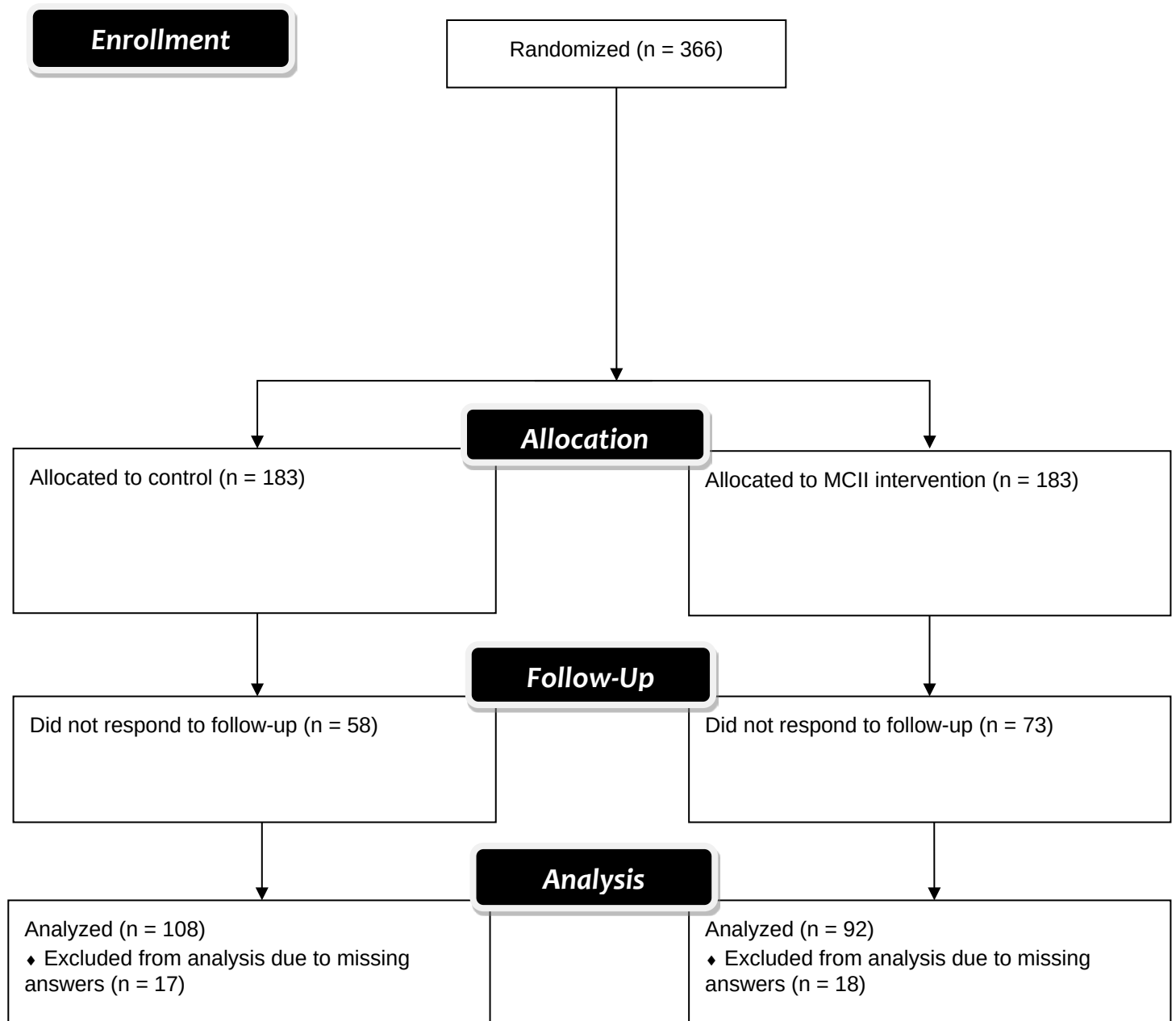


Figure 2. Participant flow.

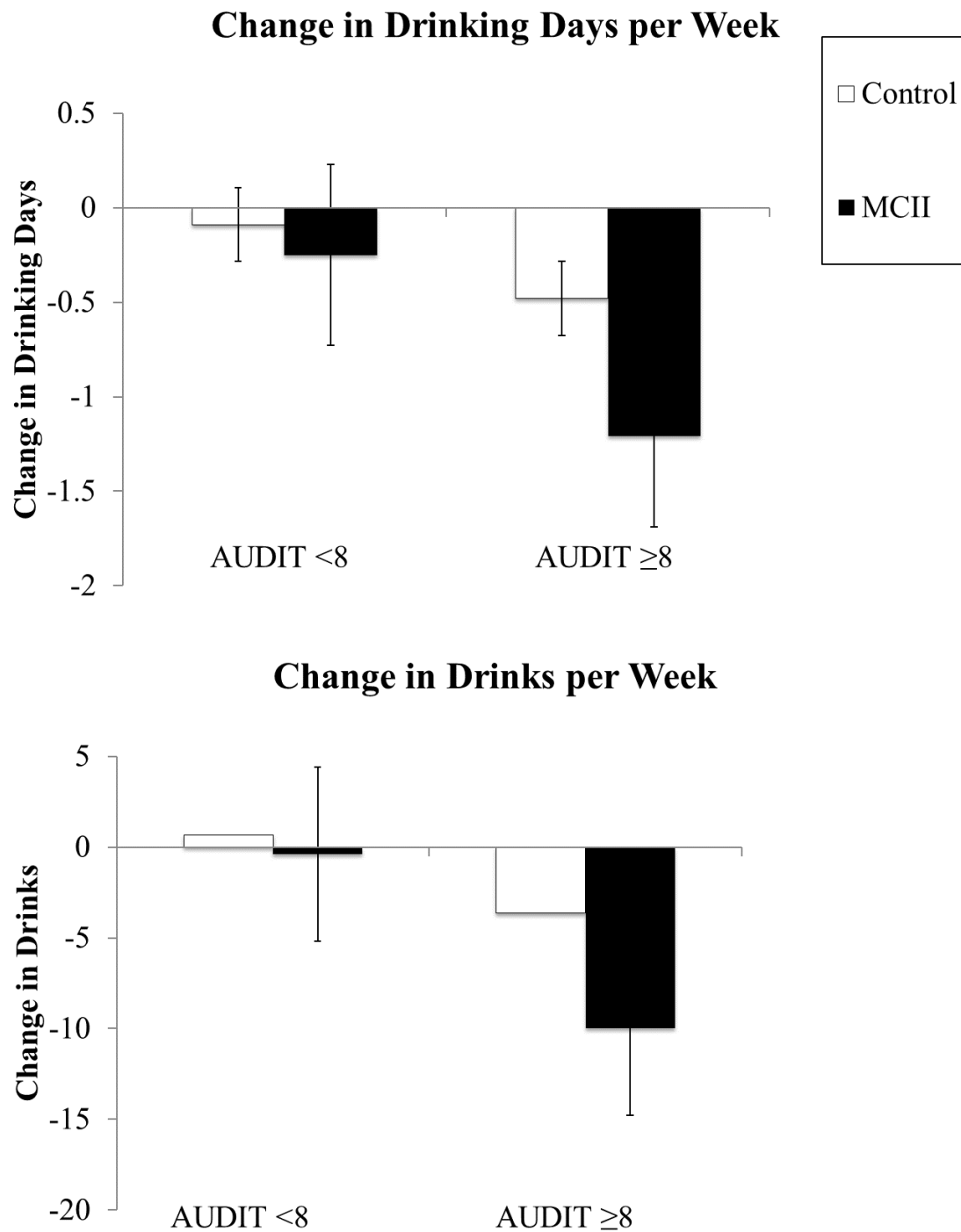


Figure 3. Mean change for drinking days per week, drinks per week by condition (MCII vs. Control) and hazardous drinking (i.e., AUDIT).