The effect of the 'What Do You Drink' web-based brief alcohol intervention on
self-efficacy to better understand changes in alcohol use over time: Randomized controlled trial using ecological momentary assessment

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ABSTRACT

Background: To examine whether (1) the 'What Do You Drink' (WDYD) intervention resulted in drinking refusal self-efficacy (DRSE) changes directly after the intervention, and if so, whether these changes sustained at six-months follow-up and (2) DRSE was related to alcohol use over time, and if so, whether the strength of these relationships differed across conditions. Insight herein can help explain the sustained preventive effects of the WDYD intervention on alcohol use, as reported previously.
Methods: Alcohol use and DRSE data were collected from 907 participants (60.3% male; $M = 20.8$ (SD = 1.7) in a two-arm parallel group randomized controlled trial applying ecological momentary assessment with 30 time-points. Participants were randomized to the experimental ($n = 456$: WDYD intervention) or control condition ($n = 451$: no intervention).
Results: Latent Growth Curve (LGC) analyses that modeled individual change in DRSE over time by condition revealed that participants in the experimental condition experienced a higher social pressure DRSE compared to participants in the control condition at six-months follow-up. Moreover, LGC analyses with time-varying covariates revealed that DRSE was negatively related to weekly alcohol consumption and social pressure DRSE to frequency of binge drinking. The WDYD intervention did not affect the strength of these relationships.
Conclusions: The WDYD intervention increased the level of social pressure DRSE directly after the intervention that sustained at six-months follow-up. This change is likely to be responsible for the sustained preventive effects of the WDYD intervention on alcohol use, as reported previously.

1. Introduction

Excessive alcohol use among young adults is a leading cause of mortality and morbidity and related social and economic costs (Hingson et al., 2009). Over the past decades, several web-based brief alcohol interventions have been developed to target excessive alcohol use among students (Bewick et al., 2008; Chiauzzi et al., 2005; Doumas and Andersen, 2009; Hester et al., 2012; Hustad et al., 2010; Kypri et al., 2004; McCambridge et al., 2013; Walters et al., 2007). This development is mostly due to the proliferation of computer technology and the Internet (White et al., 2010) as well as the advantages of web-based interventions over face-to-face interventions regarding accessibility, anonymity, and cost-effectiveness (Riper et al., 2009). Web-based brief alcohol interventions are found to be effective in reducing excessive alcohol use among students (Bewick et al., 2013; Kypri et al., 2013). Several reviews have emphasized the relevance of evaluating the effects of web-based brief alcohol interventions on alcohol-related cognitions (e.g., social norms, self-efficacy) to better understand the underlying mechanisms of change in alcohol use (Carey et al., 2009; Elliott et al., 2008; Kaner et al., 2009). Yet, web-based brief alcohol intervention trials that looked into alcohol-related cognitions as mechanisms of change among students are limited and focused

mostly on social norms (Carey et al., 2010; Lewis and Neighbors, 2007; Pengpid et al., 2013; Turrisi et al., 2009; Walters et al., 2007; Wood et al., 2010). This is remarkable, since most web-based brief alcohol interventions address alcohol-related cognitions as part of their intervention considering that these cognitions are theoretically expected to influence alcohol use (Collins and Carey, 2007; Cullum et al., 2010; Lewis et al., 2010; Oei et al., 2005; Young et al., 2006). The results of brief alcohol intervention trials that conducted analyses on self-efficacy as a working mechanism are inconsistent, not conducted online among students, and/or used few time-points to assess the outcome measures. Barnett et al. (2010) investigated self-efficacy as a working mechanism of their brief alcohol intervention among patients aged 18–24 years who were admitted for alcohol related incidents at an emergency room in a trauma center and found no effects at six and 12-months follow-up. In addition, the results of Kulesza et al. (2013) revealed no proof of self-efficacy as a working mechanism of their brief alcohol intervention among students at one-month follow-up. Besides, Black et al. (2012) demonstrated self-efficacy related to the social situations as a mechanism in the relation between their brief alcohol intervention and alcohol use at one and four-months follow-up among students with social anxiety.

In 2010, we developed the 'What Do You Drink' (WDYD) web-based brief alcohol intervention using the Intervention Mapping protocol (Bartholomew et al., 2001), a sound framework for theoretical and evidence based development, implementation, and evaluation of effective behavioral change interventions. The WDYD intervention aims to reduce heavy drinking among young adults and is based on Motivational Interviewing (MI) principles (Miller and Rollnick, 2002) and parts of the I-Change model (De Vries et al., 1988). Knowledge, social norms, and self-efficacy are incorporated in the WDYD intervention as most changeable determinants of behavioral change. Part one of the WDYD intervention focuses on increasing participants' awareness of the potential problems, consequences, and risks associated with their drinking behavior by providing personalized normative feedback based on their answers on a screening test. The personalized normative feedback contains comparative information about personal drinking levels and drinking levels of same-sex peers to correct misperceptions of descriptive social norms conform social influence models. Part two of the WDYD intervention focuses on goal setting, action planning, and strengthening participants' drinking refusal self-efficacy (DRSE) by providing advice and tips to succeed and maintain drinking goals for 12 risk situations (i.e., situations in which people find it hard to resist alcohol).

Recently, we examined whether the WDYD intervention could sustain a reduction in alcohol use among heavy drinking students by using ecological momentary assessment (EMA) with 30 time-points. EMA is a repeated sampling strategy of behaviors in real-life settings at strategically selected moments in time (Shiffman et al., 2008). Although the WDYD intervention did not result in an overall reduction effect on alcohol use, the results of our previous study revealed that participants in the experimental condition showed lower weekly alcohol consumption and frequency of binge drinking directly after the intervention compared to participants in the control condition (Voogt et al., 2014). These effects sustained at three and six-months follow-up, respectively, and indicated that participants in the experimental condition stabilized, whereas participants in the control condition deteriorated by increasing their alcohol use. Although the preventive effects of the WDYD intervention on alcohol use were small, the use of EMA with multiple time-points and Latent Growth Curve (LGC) modeling techniques resulted in identifying intervention effects that would remain undetected when using a traditional approach with few time-points (i.e., baseline assessment, one-month follow-up, and

six-months follow-up) to test intervention effectiveness (Voogt et al., 2013b).

DRSE is defined as one's belief in the ability to resist alcohol. Three DRSE states relevant to young adults can be distinguished: (1) drinking related to emotional relief (e.g., 'when I am angry'), (2) drinking related to opportunity (e.g., 'when I am watching TV'), and (3) drinking related to social pressure (e.g., 'when my friends are drinking') (Lee and Oei, 1993; Young et al., 1991). High overall DRSE (Collins et al., 2011) and high opportunity and high social pressure DRSE (Baldwin et al., 1993; Ehret et al., 2013; Young et al., 1991) are related to reduced alcohol use. The sustained preventive effects of the WDYD intervention on alcohol use could thus be manifested by an increase in DRSE states directly after the intervention. However, both DRSE states (Van Zundert et al., 2010) and alcohol use (Maggs et al., 2011; Neighbors et al., 2011) are dynamic constructs that fluctuate over time. To capture variations in DRSE states and alcohol use over time, a repeated sampling strategy with short time intervals is needed to adequately assess the interplay between DRSE states and alcohol use and to establish whether the WDYD intervention might have an effect on this interplay. Accordingly, this study used EMA with 30 time-points and explored series of LGC models without and with time-varying covariates (TVCs) to examine (1) whether the WDYD intervention resulted in changes in DRSE states directly after the intervention, and if so, whether these changes sustained at six-months follow-up and (2) whether DRSE states were related to alcohol use over time, and if so, whether the strength of these relationships differed across conditions. Insight herein can help explain the sustained preventive effects of the WDYD intervention on alcohol use among heavy drinking students, as reported in our previous study (Voogt et al., 2014).

This study uses a range of innovative methodological, theoretical, and analytical elements. First, EMA was used to assess the effects of a web-based brief alcohol intervention on DRSE states and the relationship between DRSE states and alcohol use. The advantage of EMA is that it repeatedly assesses the outcome measures at strategically selected moments in time, thereby considering the fluctuating nature of individuals' cognitions and behavior over time, such as DRSE states and alcohol use. In addition, repeated measures data of DRSE states and alcohol use usually fit well by LGC models in which average group growth trajectories (i.e., mean intercepts and slopes) and between-individual differences in these trajectories (i.e., intercept and slope variances) are estimated (Muthén and Muthén, 1998–2010). The estimation of variances in growth trajectories increases the reliability of DRSE states and alcohol use, which is not possible with traditional techniques, such as repeated-measures ANOVA (Cunningham et al., 2009), since they provide only mean growth patterns and treat variances as error (Hardy and Thiels, 2009). Second, to our knowledge, no web-based brief alcohol intervention trials have attempted to test the working mechanisms of DRSE states in explaining intervention effects on alcohol use among students using EMA with multiple time-points. Brief alcohol intervention trials that conducted mediation analyses of DRSE exist, but the results are inconsistent and these trials are not conducted online among students and/or used few time-points to assess the outcome measures (Barnett et al., 2010; Black et al., 2012; Kulesza et al., 2013). It should be acknowledged, however, that conventional mediation analyses could not be applied in the present study considering that DRSE states were assessed in the moment, whereas alcohol use was assessed retrospectively. Accounting for the differences between how DRSE states and alcohol use were assessed within one LGC model was not feasible. However, this study can help explain the sustained preventive effects of the WDYD intervention on alcohol use, as reported in our previous study (Voogt et al., 2014). Finally, we focused on the differential effects of three DRSE states individually instead of an