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FOUR-YEAR FOLLOW-UP OF AN INTERNET-BASED BRIEF INTERVENTION FOR UNHEALTHY ALCOHOL USE IN YOUNG MEN

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ABSTRACT

Aim

The aim was to estimate the long-term efficacy of an internet-based brief intervention (IBI) in decreasing alcohol use on 1.) number of drinks/week and 2.) monthly or more binge drinking prevalence. In addition, overall changes in alcohol use were assessed.

Design

Participants in a cohort study were recruited in a two parallel-group randomized controlled trial of an IBI versus no-intervention control condition, showing a positive intervention effect at 6 months. As part of the regular cohort assessments, participants were re-assessed 47 months after the initial trial, offering an opportunity to determine long-term efficacy.

Setting

Young Swiss men from the general population.

Participants

Of 737 randomized trial participants with unhealthy alcohol use (>14 drinks/week or ≥ 6 drinks/occasion at least monthly, or Alcohol Use Disorders Identification Test (AUDIT) ≥ 8), 622 completed a cohort assessment at mean (SD) 47.4(2.6) months after their randomized trial baseline assessment.

Intervention

IBI: normative and personalized feedback on alcohol use, risk indicators, information about alcohol and health, and recommendations. Controls: assessment only.

Measurements

Self-reported number of drinks/week and monthly or more binge drinking prevalence.

Findings

Comparisons at follow-up were adjusted for baseline drinking. Missing values were replaced with the last observation carried forward. There was no evidence of differences between the IBI and control group on either the number of drinks/week (IBI: 10.8[14.2]; control: 10.7[14.1], p=0.8) or monthly or more binge drinking prevalence (IBI: 65.1%; control: 63.5%, p=0.5). Although there was no evidence of overall change from baseline in number of drinks/week (9.8[7.9] at baseline, 10.8[14.1] at 47 months, p=0.051), there was evidence that monthly or more binge drinking prevalence had decreased over the follow-up time (84.9% at baseline, 64.3% at 47 months, p<.001).

Conclusions

The short-term efficacy of an IBI directed at unhealthy alcohol use among young men was not maintained 4-years later.

INTRODUCTION:

Very few young adults with unhealthy alcohol use actively seek treatment services [1]. In efforts to bring these services to them, some screening instruments and brief interventions have been developed. Several of these have demonstrated efficacy within primary care for individuals who are not seeking treatment [2, 3]. The World Health Organization recommends universal screening and brief intervention for those with unhealthy alcohol use, as do the US Preventive Services Task Force and NICE in the UK [4-6]. A number of electronic interventions using CD-ROMs, computers, and the internet, have been developed and tested [7, 8]. Electronic screening and brief intervention is considered an effective method for reducing unhealthy alcohol use [9, 10]. Intervention effects presumably fade over time; however, there is currently a lack of knowledge of the long-term effects of electronic brief interventions. Dedert et al. [10] indicated in their systematic review very little evidence for outcome beyond six months. One study [11] evaluated results among students who were randomized to a control condition, or to receive intervention once or bi-annually. At two years, there were modest reductions in weekly drinking within the group that received the intervention twice a year [11]. To our knowledge, no one has researched intervention effects beyond two years.

Previously, we tested the efficacy of an internet-based intervention (IBI) for unhealthy alcohol use among Swiss young men from the general population [12]. Participants in the randomized trial had assessments at baseline, 1 month and 6 months. Significant intervention effects were shown for volume of drinking (number of drinks per week) at six months, which was the planned duration of the trial. At six months, participants in the

intervention group reported significantly less drinks per week (IRR [95%CI]: 0.90 [0.81; 0.99]) but significantly not less binge drinking (OR [95%CI]: 0.93 [0.66; 1.31]).

Participants in the present randomized trial were recruited among participants of the ongoing Cohort on Substance Use Risk Factors (C-SURF) [13]. The randomized trial cohort participants completed their scheduled follow-up C-SURF assessments in 2016-2017, presenting an opportunity to evaluate potential long-term effects of intervention nearly four years later. The aims were to compare participants randomized to receive an IBI with participants randomized to receive a no-intervention control condition on 1.) number of drinks per week (using a negative binomial regression model) and 2.) monthly or more binge drinking prevalence (using a logistic regression model). In addition, we aimed at testing overall changes in the number of drinks per week and monthly or more binge drinking prevalence over the course of follow-up, using generalized estimating equations with a negative binomial distribution for number of drinks per week and McNemar's test for binge drinking.

METHODS:

Randomized trial and cohort assessment:

Potential randomized trial participants were recruited among C-SURF participants: starting June 2012, 4365 C-SURF participants were invited to participate in the internet-based brief intervention randomized controlled trial. Of these, 1633 (37.4%) completed the screening and 737 (45.1%) reported unhealthy alcohol use (defined as drinking > 14 drinks/week or ≥ 6 drinks/occasion at least monthly, or Alcohol Use Disorders Identification Test (AUDIT) scores ≥ 8). Those reporting unhealthy alcohol use were randomized to an assessment only control condition (n=370) or the intervention

condition (IBI) (n=367). The IBI consisted of web-based personalized feedback and information about unhealthy alcohol use and included: normative feedback, feedback on reported consequences of drinking, calorific value of reported consumption (with equivalents depicted as hamburgers and chocolate bars), computed blood alcohol concentration (for reported maximum number of drinks per occasion), indication of risk, information on alcohol and health and recommendations (i.e. low-risk drinking limits). The randomized trial follow-up duration was 6 months and ended in October 2013. C-SURF is still ongoing, offering the opportunity to evaluate potential long-term effects of the intervention. All C-SURF participants (including the 737 participants in the randomized controlled trial) were invited to complete a scheduled follow-up cohort assessment in 2016-2017. For the 737 randomized trial participants, this scheduled cohort assessment (the first since the completion of the randomized trial) took place about four years after their randomized trial baseline assessment. We used data collected at baseline as part of the randomized trial and data from the 2016-2017 cohort assessment (i.e. the cohort assessment data was used as a 47 months follow-up assessment for the randomized trial). Analyses followed the same plan used in the randomized trial. The primary outcome was the mean number of drinks per week at the cohort assessment. The second primary outcome was monthly or more binge drinking prevalence.

Measures:

All measures were self-reported. The number of drinks per week was assessed using questions on the typical frequency of drinking and amount consumed per typical drinking day [14-16]. The number of drinks per week was obtained by multiplying the

number of drinking days/week by the number of standard drinks/drinking day. The monthly or more binge drinking prevalence was assessed using the reported frequency of binge drinking. Binge drinking was defined as drinking 6 or more drinks on one episode. Possible answers were: “never”, “less than monthly”, “monthly”, “weekly”, “daily or almost daily”, later dichotomized into presence (i.e. monthly or more) or absence (never or less than monthly) of monthly or more binge drinking.

Covariates:

Alcohol Use Disorder Identification Test (AUDIT): the AUDIT is a 10-item validated questionnaire developed by the World Health Organization to assess alcohol use and alcohol-related problems [17]. Age was recorded upon inclusion in the randomized controlled trial.

Analyses:

A negative binomial regression model was used to assess the intervention effect on mean number of drinks per week. A logistic regression model was used to assess the intervention effect on monthly or more binge drinking prevalence. Analyses were adjusted for outcome baseline values, as well as linguistic region, Alcohol Use Disorder Identification Test scores, and age. Among participants with missing values on number of drinks per week and monthly or more binge drinking at 47 months, missing values were replaced with the last observation carried forward. Two sensitivity analyses were conducted: one with the baseline observation carried forward used to handle missing values, the other with multiple imputation.

Changes between baseline and the 47 months follow-up within the overall sample were evaluated, using generalized estimating equations with a negative binomial distribution for number of drinks per week and McNemar's test for monthly or more binge drinking prevalence.

The cohort study (C-SURF) and the randomized trial have been approved by the Ethics Committee for Clinical Research in the Canton of Vaud (C-SURF: Protocol No. 15/2007; Internet trial: Protocol No. 260/2011).

RESULTS:

Of the 737 trial participants with unhealthy alcohol use randomized to an internet-based intervention, 626 (85.0%) completed the follow-up cohort assessment, conducted at mean (SD) 47.4 (2.6) months following the randomized trial baseline assessment. In addition, two participants had missing values on the binge drinking outcome. Missing values were replaced with the last observation carried forward. For the number of drinks per week, there were 111 missing values at 47 months. The 6 months value was carried forward for 87 participants, the 1 month value for 18 participants, and the baseline value for 6 participants. For binge drinking, there were 113 missing values at 47 months. The 6 months value was carried forward for 90 participants, the 1 month value for 17 participants and the baseline value for 6 participants.

The participants baseline and 47 months follow-up characteristics are reported in Table 1. Overall, there was a significant decrease in monthly or more binge drinking prevalence and a modest non-significant increase in number of drinks per week.

There were no significant intervention effects for weekly drinking and monthly or more binge drinking prevalence at 47 months (Table 2). Being from the French sector was independently associated with more binge drinking and with a higher number of drinks per week. Baseline drinking measures (weekly drinking, binge drinking and AUDIT score) were associated with drinking at 47 months.

If the assumption is made that those missing at final follow-up had returned to baseline drinking levels, and these values used rather than the last record value (i.e. baseline value carried forward), the results were similar to those from the last value carried forward analysis. There was no intervention effect on the number of drinks per week: IRR 0.99 (0.89; 1.11), p=0.915, and no intervention effect on binge drinking prevalence: OR 0.99 (0.71; 1.38), p=0.947. Similarly, in analyses using multiple imputation to handle missing values, there was no intervention effect on the number of drinks per week: IRR 1.00 (0.87; 1.15), p=0.975, and no intervention effect on binge drinking prevalence: OR 0.97 (0.67; 1.40), p=0.872.

DISCUSSION:

We found no effects from an internet-based brief intervention (IBI) aimed at reducing unhealthy alcohol use four years later. In addition, there were no significant changes in weekly drinking in both groups. Monthly or more binge drinking prevalence decreased significantly in both groups, but the intervention did not lead to additional decreases over and above the natural history of binge drinking in the study population, possibly reflecting regression to the mean. Intervention group participants appeared to increase weekly drinking slightly less and decrease binge drinking slightly more than did those in

the control group, but these differences were not clinically or statistically significant. The benefits from intervention seen at six months were not sustained four years later. Sensitivity analyses using multiple imputation and baseline value carried forward strongly confirmed findings.

Despite the methodological limitations of our study that was not originally designed to look at long-term effects, our results are in line with a study that looked at the results of a web-based normative feedback intervention after two years. There were limited effects accrued from a biannual intervention on weekly drinking in both men and women, and on alcohol-related problems among women, but no intervention effects if the intervention was delivered only once [11]. Considering that our participants were all males and received only one intervention, the absence of any significant reductions in drinking seems consistent with these findings. The other study found decreases in weekly drinking among the participants, whereas we observed increased weekly drinking in our sample. However, in both samples heavy episodic drinking was reduced. These contrasts may be indicative of cultural differences in the natural history of drinking between American and Swiss youth.

The strengths of our study include a real-world context. It would have been very challenging and costly to pursue this research and maintain a high follow-up rate for randomized testing of the efficacy of IBI outside the framework of a large ongoing cohort project. Moreover, the existing cohort structure and protocol allowed us to efficiently conduct the necessary additional analyses. Our study has several limitations. The calendar span of the cohort assessment limits conclusions regarding the diminishing intervention effect over time. Benefits could have fallen off at any point between six and

47 months. It would have been helpful if alcohol use could have been recorded at multiple intervals, in order to determine the dynamics and interactions influencing this process. Nevertheless, these results yield information to help formulate reasonable expectations about what can be gained from IBI. In another study, even an initial intervention of once a week for 4 weeks and a booster intervention at 3 months showed no effects after 1 year [18]. This suggests that periodic interventions over the course of time would be needed. Because the sample consisted only of males, results cannot be generalized to women. Also, as participants were recruited among participants in a cohort study, selection bias may have been introduced and the sample may not be truly representative of the source population. Nevertheless, the sample consisted of a large cross-section of young men, and we consider our results can be generalized to young men willing to respond to a confidential invitation to access a website on substance use. In conclusion, we found no sustained beneficial effects of an internet-based brief intervention among young men with unhealthy alcohol use four years later. Without additional interventions to sustain potential gains, any long-term benefits of IBI should probably not be expected to occur. Future research should focus on how to structure and systematically deliver internet-based brief interventions that maximally help young individuals reduce their drinking, in both the short and the long term.

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Trial registration:
The randomized trial was registered at current controlled trials: ISRCTN55991918.

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Author Contributions
Conceived and designed the experiment: NB JS JBD JAC BB GG. Analyzed the data: NB JS GG. First draft of the manuscript: NB JS. Final version NB JS JBD JAC GG BB. Secured funding: NB JBD JAC GG BB. Previous work in intervention design: JAC NB.

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Table 1: Characteristics of participants.

	Full Sample (n = 737)		Intervention group (n = 367)		Control group (n = 370)	
	Baseline	**47 months**	**Baseline**	**47 months**	**Baseline**	**47 months**
Age, mean (*SD*)	20.7 (1.1)	25.0 (1.1)	20.7 (1.2)	25.0 (1.2)	20.8 (1.1)	25.0 (1.1)
Linguistic region, n *(%)*						
French-speaking	349 (56.1)	-	159 (51.5)	-	190 (60.7)	-
German-speaking	273 (43.9)	-	150 (48.5)	-	123 (39.3)	-
Number of drinks/week, mean (*SD*)	9.8 (7.9)[a]	10.8 (14.1)[a]	10.1 (7.9)	10.8 (14.2)	9.5 (7.8)	10.7 (14.1)
Monthly or more binge drinking prevalence, n *(%)*	626 (84.9)[b]	474 (64.3)[b]	314 (85.6)	233 (63.5)	312 (84.3)	241 (65.1)
AUDIT score, mean (*SD*)	10.6 (4.2)	-	10.7 (4.3)	-	10.5 (4.0)	-

Note. *SD*: standard deviation. AUDIT: Alcohol Use Disorders Identification Test. [a]non significant difference between baseline and 47 months follow-up, $\chi^2(1) = 3.82$, $p = .051$. [b]significant difference between baseline and 47 months follow-up, $\chi^2_{McNemar}(1) = 95.80$, $p < .001$.

Table 2: Adjusted analyses estimating the intervention effect at 47 months on weekly drinking (number of drinks per week) and monthly or more binge drinking prevalence.

	IRR	*95% CI*	*p*
Number of drinks per week[a]			
Intervention (ref: controls)	0.99	0.88, 1.10	.803
French linguistic region (ref: German)	1.13	1.00, 1.27	.048
Baseline AUDIT score	1.04	1.02, 1.05	<.001
Baseline number of drinks per week	1.04	1.03, 1.05	<.001
Age	1.05	1.00, 1.10	.059
	OR	***95% CI***	***p***
Monthly or more binge drinking prevalence (at least one episode per month)[b]			
Intervention (ref: controls)	0.90	0.65, 1.25	.537
French linguistic region (ref: German)	1.61	1.16, 2.25	.005
Baseline AUDIT score	1.17	1.12, 1.23	<.001
Baseline binge drinking	3.60	2.33, 5.54	<.001
Age	0.86	0.74, 1.00	.047

Note. AUDIT: Alcohol Use Disorders Identification Test. *IRR*: Incidence rate ratio. OR: Odds ratio. CI: confidence interval. [a] Negative binomial regression. [b] Logistic regression.