Electronic screening and brief intervention for risky drinking in Swedish university students — A randomized controlled trial

Diana Stark Ekman [a], Agneta Andersson [a,b], Per Nilsen [a], Henriettae Ståhlbrandt [a,1],
Anne Lie Johansson [a], Preben Bendtsen [a,*]

[a] Division of Social Medicine and Public Health Science, Department of Medical and Health Sciences (IMH), Linköping University, SE-581 83, Linköping, Sweden
[b] Local Health Care Research and Development Unit, County Council in Östergötland, SE-581 85 Linköping, Sweden

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ABSTRACT

Background: The limited number of electronic screening and brief intervention (e-SBI) projects taking place in young adult student populations has left knowledge gaps about the specific methods needed to motivate reduced drinking. The aim of the present study was to compare differences in alcohol consumption over time after a series of e-SBIs was conducted with two groups of young adult students who were considered risky drinkers. The intervention group (IG) ($n = 80$) received extensive normative feedback; the control group (CG) ($n = 78$) received very brief feedback consisting of only three statements.
Method: An e-SBI project was conducted in naturalistic settings among young adult students at a Swedish university. This study used a randomized controlled trial design, with respondents having an equal chance of being assigned to either the IG or the CG. The study assessed changes comparing the IG with the CG on four alcohol-related measurements: proportion with risky alcohol consumption, average weekly alcohol consumption, frequency of heavy episodic drinking (HED) and peak blood alcohol concentration (BAC). Follow-up was performed at 3 and 6 months after baseline.
Results: The study documented a significant decrease in the average weekly consumption for the IG over time but not for the CG, although the differences between the groups were non-significant. The study also found that there were significant decreases in HED over time within both groups; the differences were about equal in both groups at the 6-month follow-up. The proportion of risky drinkers decreased by about a third in both the CG and IG at the 3- and 6-month follow-ups.
Conclusions: As the differences between the groups at 6 months for all alcohol-related outcome variables were not significant, the shorter, generic brief intervention appears to be as effective as the longer one including normative feedback. However, further studies in similar naturalistic settings are warranted with delayed assessment groups as controls in order to increase our understanding of reactivity assessment in email-based interventions among students.

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1. Background

Alcohol use is a normal part of life for many university students. A recent survey of more than 18,000 students aged 17–30 years in 21 countries found that substantial numbers used alcohol, ranging from 29% of men and 6% of women in South Africa to 95% of men and 93% of women in Ireland (Dantzer, Wardle, Fuller, Pampalone, & Steptoe, 2006). Young adult students in Sweden also show evidence of high alcohol consumption. A survey conducted with 4575 undergraduate university students on four campuses in Sweden found that 96% of students had consumed alcohol in the preceding 12 months (Bullock, 2004). A recent study surveyed 1585 first-year students in Linköping University, and found that heavy episodic drinking (HED), defined as drinking 60 g of alcohol or more for men and 48 g or more for women on a single occasion at least once a month, was reported by 51% of the women and 71% of the men (Bendtsen, Johansson, & Akerlind, 2006). An earlier report about university students, also set in Linköping University, Sweden, found that of the 1297 third-semester students who completed electronic screenings and brief interventions (e-SBIs), 91% ($n = 1186$) reported that they had consumed alcohol in the preceding 3 months (Andersson, Wirehn, Olvander, Ekman, & Bendtsen, 2009). About 84% of men and 71% of women reported engaging in HED once a week or more.

* Corresponding author. Tel.: +46 10 1032383; fax: +46 10 1031865.
E-mail addresses: agneta.g.andersson@lio.se (A. Andersson), per.nilsen@liu.se (P. Nilsen), henrietta.stahlbrandt@med.lu.se (H. Ståhlbrandt), anne.lie.johansson@liu.se (A.L. Johansson), preben.bendtsen@liu.se (P. Bendtsen).
[1] Permanent address: Clinical Alcohol Research, Clinical Alcohol Research, Entrance 108, UMAS, SE — 205 02 Malmö, Sweden.

Given the high prevalence of alcohol use in young adult student populations, numerous projects have assessed the use of various forms of screening, partnered with brief interventions, in order to change drinking behaviors. Recently, a meta-analysis was published by Moreira, Smith, and Foxcroft (2009) comparing the effectiveness of various forms of alcohol interventions taking place in university or college settings that incorporated feedback on social drinking norms. The study analyzed findings from 22 randomized controlled trials (RCTs) involving 7275 students, comparing outcomes for processes involving e-SBIs, mailed feedback of pen and paper screening, individual face-to-face feedback, or group face-to-face feedback. The e-SBI methods appeared to interact with more factors related to alcohol, including peak blood alcohol concentration (BAC), drinking frequency, and drinking quantity, than other delivery methods, and were less expensive to use. However, more studies are needed to identify the specific approaches of e-SBIs that are associated with consistent evidence of reduced alcohol consumption over time. The authors of this review cite a general lack of SBI studies set outside the United States, and a lack of studies that include follow-up periods longer than 3 months. Many of the available studies described small study populations, often limited to convenience samples (i.e., psychology students) and/or involving only students who are waiting for care in health clinics (Moreira et al., 2009). Other factors affect the generalizability of e-SBI studies of young adult student populations: many required respondents to participate in e-SBIs taking place in controlled settings, rather than allowing students to access e-SBIs using their own computer (Lewis, Neighbors, Oster-Aaland, Kirkeby, & Larimer, 2007; Neighbors, Lewis, Bergstrom, & Larimer, 2006). Only a handful of published studies have described projects that made more comprehensive use of electronic media, by recruiting large numbers of participants via email, and having participants complete e-SBIs at their own convenience, using their own or another computer.

Earlier studies have assessed the effectiveness of normative feedback in helping students change drinking behaviors. The meta-analysis by Carey, Scott-Sheldon, Elliott, Bolles, and Carey (2009) found that students receiving personalized normative feedback demonstrated reductions in harmful alcohol-related behaviors. Moreira et al. (2009) stated that computerized normative feedback was associated with short-term decreases in alcohol problems, peak BAC, the quantity of alcohol consumed over time, and associated with improved knowledge of realistic drinking norms. Their meta-analysis found that students who received normative feedback from electronic media continued to show improvement over medium-term follow-ups (4–16 months) in reducing alcohol problems, frequency of drinking occasions, quantity of alcohol consumed, and number of drinking events. Overall, the authors concluded that that "individual and personalized normative interventions over the immediate and medium term appear to reduce alcohol use, misuse and related problems amongst university or college students" (Moreira et al., 2009, p. 42). However, the review documented a very limited number of RCTs involving e-SBIs that assessed changes over longer periods of time.

The limited number of e-SBI projects performed as RCTs has left knowledge gaps about how such approaches function in real life with students accessing emailed recruitment invitations and participating in e-SBIs on their own initiative, rather than in controlled settings. In particular, little is known about the specific methods needed to motivate reduced drinking in e-SBI participants. The aim of the present study was to compare differences in alcohol consumption over time, after a series of e-SBIs conducted among young adult students who were considered risky drinkers. The intervention group (IG) received extensive normative feedback; the control group (CG) received short feedback. The study's hypothesis was that at the end of the study period, the IG would have more members who were considered non-risky drinkers compared with the CG.

2. Methods

2.1. Study population and eligibility criteria

All third-semester students enrolled for the fall semester, 2007, at Linköping University (LiU) were eligible for participation in this study. The university is one of the largest in Sweden, with a population at the time of this study of more than 25,000 students. E-mails using university-issued addresses were distributed to all third-semester LiU students in October 2007, inviting them to participate in an e-SBI. Each message included a one-time-use-only hyperlink to the test. The students' e-mail addresses served as unique identifiers. After completing their first e-SBI, the test instrument asked the respondents if they would be willing to participate in follow-up e-SBIs 3 and 6 months later. The study was approved by the ethics committee in Linkoping University (DNR 141-07).

2.2. Study definitions

Students were considered risky drinkers if, at baseline or follow-up measurements, they fell into either one or both of the following categories: (a) their weekly alcohol consumption exceeded 120 g alcohol (women) or 180 g alcohol (men) per week in a typical week in the last 3 months and (b) they engaged in HED occasions defined as consuming 48 g of alcohol or more (women) and 60 g or more (men) on two or more occasions in the preceding month. In addition, as both feedbacks included information on this statistic, we assessed changes in peak BAC. The formula used to compute the BAC for our study population is published elsewhere (Andersson et al., 2009).

2.3. The study intervention

After completing their screenings for alcohol use, but before receiving feedback, respondents were randomly assigned to either the CG or the IG. The CG then received very brief feedback, consisting of three statements summarizing their weekly consumption, their frequency of heavy episodic drinking, and their highest BAC in the last 3 months comparing the respondents' drinking patterns against safe drinking limits established by the Swedish Institute for Public Health. The IG received the summary statements received by the CG and more comprehensive normative feedback with information describing participants' alcohol use compared with peers at the university, and, if applicable, advice on reducing any unhealthy levels of consumption. The personalized advice received by the IG consisted of 12 possible statements or suggestions about the student's alcohol habits.

2.4. Sample size

The baseline e-SBI study obtained 1309 responses (46% of eligible participants), with 11 responses missing data, 5 with data error and 64 that was assigned to two groups or no group for technical reasons; the study thus analyzed responses from 1229 students. Participation in the e-SBIs was strictly voluntary and included all third semester students, so sample size was not set before the study.

Baseline responses identified 654 students who were considered risky drinkers. Three participants were categorized as such solely due to high weekly consumption. Most risky drinkers, 425 (65%), were categorized as such due only to self-reports of high frequencies of HED; the other 226 (35%) reported both high weekly consumption and HED.

Of the original 330 risky drinkers assigned to the IG, only 150 agreed to participate in the follow-up; 126 students actually participated in the 3-month follow-up and 80 in the 6-month follow-up, resulting in retention rates of 38% and 24%, respectively. Of the 324 students assigned to the CG, 145 agreed to participate in the follow-up; 114 actually participated in the 3-month follow-up and 78 participated in the 6-month follow-up, resulting in retention rates of 35% and 24%, respectively.

The data were analyzed at the end of the study period, after the 6-month follow-ups, and changes were assessed only in those participants (respondents) who participated in all three testing processes (80 students in the IG and 78 in the CG).

2.5. Dates of recruitment and follow-up

Recruitment for this study's baseline measurement took place via e-mails sent to students' university email addresses during September 2007 with reminders sent to those who had not yet participated 1 week after the initial invitations. Links to participate in follow-up measurements were sent to all the participants of the baseline survey when the 3- and 6-month follow-ups were scheduled (January 2008 and April 2008, respectively). If a participant did not complete a follow-up after the first reminder, a second was sent.

2.6. Randomization processes

Participants had an equal probability of assignment to either the control or experimental groups at baseline. Randomization was achieved by computerized assignment to groups. Respondents were not told which group they had been assigned to, nor were they told that two possible types of feedback could be received.

2.7. Data processing and statistical methods

Data from all three measurements were extracted from a database placed at a web hotel (Loopia) to an Excel file and thereafter to PASW 18.0 to perform the statistical analyses. The significance level of this study was set at ≤ 0.05. Pearson's χ^2 test and Fisher's exact test were used to analyze the differences in distribution regarding sociodemographic characteristics categorized by the type of feedback (Table 1), and differences in the proportion of risky drinkers (Table 2). Differences in continuous variables, including average weekly consumption and BACs, were tested with one-way ANOVA when differences involved more than two groups; otherwise t-tests were used. Differences related to frequency of HED occasions per month (ordinal variables) between the two types of feedback were regarded as non-parametric and tested with the Kruskal–Wallis and Mann–Whitney tests. The Kruskal–Wallis test

was used when more than two independent groups were assessed; otherwise Mann–Whitney tests were used. Absolute changes in consumption within each feedback condition was tested using paired t-tests (average weekly intake and highest BAC) and Wilcoxon signed rank test (number of HED occasions per month) (Table 3).

3. Results

3.1. Comparability of study groups to non-responders and non-participants

There were no significant differences in sociodemographic characteristics or baseline drinking behavior between the IG and the CG (Table 1). This study also analyzed differences in sociodemographic characteristics and drinking behavior, comparing all respondents who participated in the three e-SBIs with students who completed only the baseline e-SBI (non-participants), and students who agreed to participate in the follow-ups, but did not actually complete all three surveys (non-responders) (Table 2). Non-responders and non-participants demonstrated significantly higher mean values for weekly consumption than responders. However, there were no significant differences seen between the three groups in HED measurements and peak BAC values. The respondent group contained more women than the other two groups.

3.2. Changes in weekly consumption over time

Comparing baseline measurements of average weekly consumption against the 3 and 6-month follow-up, the IG groups demonstrated a significant within-group decrease, whereas the CG showed a small non significant decrease. However, there was no significant difference between the groups (Table 3).

3.3. Changes in HED over time

At the 3-month follow-up, both groups demonstrated significant within-group reductions in the absolute changes in number of HED occasions per month, compared with the baseline measurements. However, the differences between the IG and CG were not significant. At the 6-month follow-up, both groups continued to demonstrate significant within-group reductions related to absolute changes in the number of HED occasions per month, but again there were no significant between-group differences. The relative change in the number of HED episodes was reduced by 34% in the IG and by 27% in the CG at the 6-month follow-up, resulting in no significant differences between the groups (Table 3).

3.4. Changes in peak BAC

The reductions in peak BAC were not significant in either group at the 3-month follow-up, nor were the differences between the two groups significant at this time. At the 6-month follow up, the within-group differences in reduction in the absolute value of the peak BAC seen for the IG narrowly missed the significance level set by the study. Within the CG, a significant reduction in the absolute peak BAC was seen. However, there were no significant differences between the two groups at the 6-month follow-up (Table 3).

3.5. Changes in status from risky drinker to non-risky drinker

About one-third of each group changed status from risky drinker to non-risky drinker at the 3-month follow-up. The differences between the groups in the number of students considered non-risky drinkers at the 3-month follow-up were not statistically significant. At the 6-month follow-up, 25% of the IG and 30% of the CG were still classified as non-risky drinkers. The differences between the groups in the number of students considered non-risky drinkers after this 6-month measurement were not statistically significant.

Table 1
Sociodemographic and drinking characteristics of the participants according to type of feedback.

	Intervention group, n (%)	Control group, n (%)
Gender ($p = 0.263$)		
Male	37 (46)	29 (37)
Female	43 (54)	49 (63)
Total	80 (100)	78 (100)
Age ($p = 0.469$)		
18–20 years	10 (13)	15 (19)
21–25 years	64 (80)	56 (72)
$\geq$ 26 years	6 (7)	7 (9)
Total	80 (100)	78 (100)
University section ($p = 0.570$)		
Faculty of arts and sciences	36 (45)	44 (56)
Institute of technology	29 (36)	23 (30)
Institute of education	6 (8)	4 (5)
Faculty of health sciences	9 (11)	7 (9)
Total	80 (100)	78 (100)
Weekly consumption, g/week ($p = 0.434$)		
Median (range)	108 (348)	108 (252)
Mean (SE)	123.3 (7.5)	115.4 (7.5)
Highest BAC ($p = 0.867$)		
Median (range)	1.22 (4.13)	1.21 (4.37)
Mean (SE)	1.26 (0.08)	1.29 (0.09)
HED ($p = 0.859$)		
Median (range)	3 (29)	3 (27)
Mean (SE)	5.9 (0.5)	6.0 (0.5)

Table 2
Sociodemographic and drinking characteristics of three categories of participants.

	Non-participants, n (%)[a]	p-value, (non-participants vs non-responders)	Non-responders, n (%)[b]	p-value (non-responders vs responders)	Responders, n (%)[c]	p-value (non-participants vs responders)
Gender (p = 0.014)						
Male	194 (54)		78 (57)		66 (42)	
Female	165 (46)		59 (43)		92 (58)	
Total	359 (100)	0.614	137 (100)	0.010	158 (100)	0.013
Age, years (p = 0.023)						
18–20	91 (25)		21 (15)		25 (16)	
21–25	245 (68)		110 (80)		120 (76)	
≥26	23 (6)		6 (4)		13 (8)	
Total	359 (100)	0.028	137 (100)	0.391	158 (100)	0.053
University section (p = 0.595)						
Arts and science	151 (42)		60 (44)		80 (51)	
Technology	132 (37)		54 (39)		52 (33)	
Education	32 (9)		10 (7)		10 (6)	
Health sciences	44 (12)		13 (10)		16 (10)	
Total	359 (100)	0.748	137 (100)	0.633	158 (100)	0.309
Type of feedback (p = 0.981)						
Long	180 (50)		70 (51)		80 (51)	
Short	179 (50)		67 (49)		78 (49)	
Total	359 (100)	0.920	137 (100)	1	158 (100)	0.924
Weekly consumption, g/week (p = 0.026)						
Median (range)	108 (504)		120 (504)		108 (348)	
Mean (SE)	134.6 (4.4)	0.252	144.6 (7.9)	0.008	119.4 (5.0)	0.042
Highest BAC (p = 0.619)						
Median (range)	1.3 (5.5)		1.2 (4.9)		1.2 (4.6)	
Mean (SE)	1.34 (0.04)	0.852	1.37 (0.08)	0.399	1.27 (0.06)	0.371
Frequency of HED, no. of HED occasions/month (p = 0.506)						
Median (range)	3 (27)		3 (16)		3 (29)	
Mean (SE)	6.0 (0.2)	0.906	6.1 (0.3)	0.338	5.9 (0.3)	0.276

[a] Non-participants: those who did not respond to any of the email surveys.
[b] Non-responders: those who answered the baseline survey but did not respond to the follow-up.
[c] Participants: those who responded to the baseline survey and both follow-up surveys.

4. Discussion

4.1. Changes in weekly consumption over time

This study documented a decrease in the average weekly consumption for both groups over time, at both the three-month and six-month follow-ups. However, the decrease was only significant for the IG and at the 6-month follow-up the decrease in the IG was 23% in contrast to a non significant 7% decrease in the control group.

It is possible that some of the decrease in the average weekly consumption seen at the 6-month follow-up vs the 3-month follow-up was related to the fact that students knew they would be reporting consumption. We note that the actual mean of the average weekly consumption in grams at the 6-month follow up, were about 100 g for

Table 3
Effectiveness of the two types of feedback for risky drinkers in the IG and CG, comparing changes from baseline measurements with those taken at 3- and 6-month follow-ups for average weekly consumption, HED, and BAC measurements.

	3-month follow-up			6-month follow-up		
	Intervention (n = 80)	Control (n = 78)	p-value	Intervention (n = 80)	Control (n = 78)	p-value
Average weekly consumption (g) at baseline, mean (median)	123.3 (108)	115.4 (108)	0.434	123.3 (108)	115.4 (108)	0.434
Average weekly consumption (g) at follow-up, mean (median)	108.0 (96)	113.7 (90)	0.644	100.1 (102)	108.6 (102)	0.481
Absolute change in average weekly consumption (g) between baseline and follow-up (p-value)	− 15.3 (0.014)[a]	− 1.7 (0.812)[b]	0.147	− 23.2 (0.003)[a]	− 6.8 (0.220)[b]	0.085
Relative change (%) in average weekly consumption between baseline and follow-up	− 12	− 1		− 19	− 6	
Number of HED occasions per month at baseline, mean (median)	5.9 (3)	6.0 (3)	0.859	5.9 (3)	6.0 (3)	0.859
Number of HED occasions per month at follow-up, mean (median)	3.5 (3)	3.7 (3)	0.755	3.9 (3)	4.4 (3)	0.603
Absolute change in no. of HED occasions per month, between baseline and follow-up (p-value)	− 2.4 (0.000)[c]	− 2.3 (0.000)[d]	0.803	− 2 (0.000)[c]	− 1.6 (0.004)[d]	0.424
Relative change (%) in no. of HED occasions per month between baseline and follow-up	− 41	− 38		− 34	− 27	
Changed from risky to non-risky (%)	34	33	1.0	25	30	0.593
Average highest BAC at baseline, mean (median)	1.26 (1.2)	1.29 (1.2)	0.867	1.26 (1.2)	1.29 (1.2)	0.867
Average highest BAC at follow-up, mean (median)	1.21 (1.2)	1.16 (1.0)	0.711	1.11 (1.0)	1.10 (1.0)	0.915
Absolute change in average highest BAC, g (p-value)	− 0.05 (0.525)[e]	− 0.13 (0.148)[f]	0.610	− 0.15 (0.067)[e]	− 0.19 (0.012)[f]	0.765
Relative change (%) in average highest BAC	− 4	− 10		− 12	− 15	

[a] Test for change in average weekly intake within the long-feedback group.
[b] Test for change in average weekly intake within the short-feedback group.
[c] Test for change in number of HED occasions per month within the long-feedback group.
[d] Test for change in number of HED occasions per month within the short-feedback group.
[e] Test for change in highest BAC within the long-feedback group.
[f] Test for change in highest BAC within the short-feedback group.

the IG and 109 g for the CG. These amounts are roughly equivalent to 8–9 bottles of beer (each 330 ml) containing 4–5% alcohol, or about 1.5 bottles (each 750 ml) of wine containing 13% alcohol. Overall, the average weekly consumption in both groups at the end of the study was less than that established as safe weekly drinking limits by the Swedish Institute for Public Health, and fairly low by international comparison with other young adult student populations. However, it cannot be excluded that the changes seen during the 6-month study period was due to seasonal variation.

In line with our findings with regard to average weekly consumption, Kypri et al. (2009) also reported a similar difference in an intervention group compared to a control group (screening only) in a similar email-based computerized intervention. In this study the intervention group drank 11% less alcohol than the control group after 6 months, which is a comparable effect size to that reported in many face-to-face interventions. The average weekly consumption at baseline in the Kypri study was in the same range as in our study.

4.2. Changes in HED over time

This study found that there were significant decreases in HED over time, despite the increase in average weekly consumption, within both the IG and CG groups; the differences between the groups were about equal. At the end of the study, 25% of the participants in the IG and about 30% of the CG moved from risky drinker status to non-risky drinker status. Three-quarters of the responders were originally classified as risky drinkers solely due to their HED measurements; the other one-fourth were classified as risky drinkers due to both HED and high weekly consumption. Kypri et al. (2004) noted similar trends toward decreased HED in both intervention and control groups in their e-SBI, which targeted young adult students in New Zealand. However, similar to our findings, at the 6-month follow-up in the Kypri study, there were no statistically significant differences in the number of HED experienced in the IG compared with the CG.

4.3. Changes in BAC over time

In their US study involving 106 young adult students who were heavy drinkers, Walters, Vader, and Harris (2007) found that at the 2-month follow up, the feedback group, which had received normative feedback, showed a significant decrease in peak BAC compared with controls. At the 4-month follow up, the control group, which had received assessment only, also showed a reduction in these measurements, resulting in no differences between the two groups. In our study, the within-in group changes in BAC at the 3-month follow-up are comparable with each other. Furthermore, at the 6-month follow-up in our study, the CG showed a significant within-group downward movement related to an absolute change in average highest BAC. Even with this measurement, however, comparison between the IG and CG does not reveal any significant differences.

4.4. Changes in status from risky drinker to non-risky drinker over time

As the differences in the number of risky drinkers moving to non-risky drinking status at the 6-month follow-up were not significant between the groups in our study, we could state that our hypothesis has been disproved. Apparently a shorter, generic brief intervention was as effective as a longer one including normative feedback, particularly in relation to reduced numbers of HED occasions over time among young adult students who were risky drinkers. However, due to the lack of an assessment-only group and a delayed-assessment group as discussed in the limitations, these conclusions should be viewed with caution. Further studies are warranted to assess the effect of the assessment and the study procedure. Based on previous studies on the effectiveness of email-based interventions

among students, we assumed that there would be a difference between the short control conditions and a longer personalized feedback and therefore decided not to have a screening-only group for ethical reasons; we wanted all students to have some feedback.

Instead we have shown the feasibility of delivering an email-based intervention to students in a naturalistic setting by emailing a link to a computerized test to the student's own email address. The effect observed in both the intervention and control groups is still somewhat surprising, given that the CG received feedback containing just three statements summarizing weekly alcohol consumption, frequency of heavy episodic drinking, and peak BACs, presented in relation to the safe drinking limits established by the Swedish Institute of Public Health. This raises the question: just how brief can an effective e-SBI be? It seems probable that there are minimum and maximum limits for optimized e-SBIs, not only for the number of questions asked of respondents, but also for the amount of feedback required to promote healthier drinking behavior. Teasing out which questions work best with which feedback items and interventional approaches will require much more study and will probably require more participants than we managed to retain in this study. A different study design, with a control group that received no screening or interventions at baseline, and a second control group that received only screening, with no feedback, would further clarify the effects of screening per se.

4.5. Participation rates and study limitations

This study assessed changes in a group of 654 students who were considered risky drinkers at baseline and who completed two follow-ups. About a quarter of this cohort of risky drinkers, who took the first e-SBI voluntarily, remained participants throughout the 6-month project. Sample sizes of young adult students recruited to participate in RCTs incorporating e-SBIs, and including follow-ups to 6 months or more, have ranged from 106 (Walters et al., 2007) to 429 (McNally & Palfai, 2003). However the attrition rates for these few studies vary from less than 10% (Kypri et al., 2004) to about 23% (Walters et al., 2007) and were much smaller than our attrition rates. In a recent study performed after our study, Kypri et al. (2009) managed to keep 1578 students for a 6-month follow-up with an attrition rate of 35%.

The relatively small number of risky drinkers who gave information at all three measurement periods for this study may mean that we had too few participants overall to fully demonstrate the effects of feedback methods. For example, our study found that non-responders and non-participants showed somewhat higher mean values for weekly consumption than the risky drinkers who participated in all three e-SBIs. Had more respondents from the first two groups taken all three e-SBIs, it is quite possible that the overall values for weekly consumption over time would be even higher for our respondent groups. Problems retaining participants have been documented in multiple follow-up studies of SBIs, not just those using electronic media. Several SBI studies have incorporated the use of incentives during recruitment or follow-up phases, including cash incentives and course credits (Kypri et al., 2009; Lewis et al., 2007; McNally & Palfai, 2003; Murphy et al., 2001; Neal & Carey, 2004). It is possible that this study may have had more follow-up participation if incentives had been used.

For the randomization, it is possible that individual respondents could have surmised that they were part of a study that was comparing differences in drinking behaviors and/or e-SBI feedback (e.g., if friends or roommates took the test at about the same time and compared feedback results), but students would not have been able to determine the parameters for membership in either a control or experimental group by comparing one set of feedback against another, as participants were informed by the e-SBI that each was receiving personalized feedback.

Also the assessment reactivity might have been underestimated when designing this study. In a recent review of brief alcohol interventions, an unexpected reduction in drinking was noted in control groups (Kaner et al., 2007). It appears to be not uncommon to have a 20% reduction in control groups who do not receive an evaluated intervention. Such reductions have usually been explained by regression to the mean, effects of natural variation in people's drinking patterns, and by a possible intervention effect due to the assessment and research procedure (Epstein et al., 2005; Jenkins, McAlaney, & McCambridge, 2009).

One way to test for effects of the assessment in online studies is through the use of a delayed assessment approach or waiting list as a control group. A recent study by Walters, Vader, Harris, and Jouriles (2009) used this approach whereby 147 university students completed a two-item screening questionnaire about age and frequency of heavy drinking in the past 2 weeks. The delayed assessment group was not contacted until 12 months later. The assessment group was asked to complete an extensive assessment that took about 25 min, and they completed a similar questionnaire at 3 and 6 months. The study participants were all informed that they were participating in a study and might or might not get an intervention. However, neither of the groups received a formal intervention; they were only asked to complete the assessments. After 12 months, the assessment group showed a significant reduction in risky drinking but not on overall quantity of drinking. The possible effectiveness of assessment or monitoring of drinking behavior was thus supported.

In our study, the IG received a longer, more conventional, brief intervention in contrast to the control group who received a very short summary of their drinking with no advice about reducing their consumption. Our findings point to no differences in alcohol consumption after 3 and 6 months, therefore we still do not know whether the changes observed in both groups were due to the assessment or whether both the intervention and control conditions had a similar effect on consumption. In order to study the true effect of an intervention, it is desirable and ethical (because we do not know the effects of assessment) that future studies not only include a pure control group (assessment only, no feedback) but also a delayed assessment group (no assessment or intervention at baseline).

5. Conclusions

The specific characteristics shared by students who benefit most from e-SBIs are still not fully known. The most reliable, and valid, information about the effectiveness of e-SBIs will be obtained through multiple assessments over time involving large numbers of participants. Electronic media are inexpensive, and do not require direct oversight by a staff, and thus can be used to good effect in large-scale studies. Our study further demonstrated that e-SBIs are easily replicated in non-English speaking countries, which will help increase knowledge of the effectiveness of the e-SBI approach in non-English speaking countries. The study demonstrates the adaptability of e-SBIs to naturalistic settings, without the need for expensive, on-site, project management or face-to-face interventions. This study further implies that very short electronic interventions were associated with reductions in the number HED occasions in young adult students who are risky drinkers, indicating that e-SBIs need not involve much time from participants to be effective. If students drinking at hazardous or harmful levels can be influenced to reduce their drinking by a combination of a simple screening and the Hawthorne effect, large-scale implementation of screening surveys among university students might have a considerable effect on public health, with no need for a more sophisticated normative feedback intervention. Further studies in similar naturalistic settings are warranted with delayed assessment

groups as controls in order to increase our understanding of reactivity assessment in email-based interventions among students.

Contributors

Authors contributing to this paper included: DSE, co-author, all drafts of this paper, assisted in statistical analysis. AA, primary investigator, co-author of all drafts of this paper, assisted in statistical analysis, study design. PN, co-author, all drafts of this paper. ALJ, statistical analysis. HS, co-author, final draft, assisted in study design. PB, original research idea and co-author, assisted in statistical analysis, all drafts of this paper. All authors approved to the final version of this paper.

Conflict of Interest

Preben Bendtsen is partner of a company that develops similar applications as the one used in this study.

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