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Abstract

Objective: Alcohol misuse amongst University students is a serious concern, and research has started to investigate the feasibility of using e-health interventions. This study aimed to establish the effectiveness of an electronic web-based personalised feedback intervention through the use of a randomised control trial (RCT).

Method: 506 participants were stratified by gender, age group, year of study, self-reported weekly consumption of alcohol and randomly assigned to either a control or intervention condition. Intervention participants received electronic personalised feedback and social norms information on their drinking behaviour which they could access by logging onto the website at any time during the 12 week period. CAGE score, average number of alcoholic drinks consumed per drinking occasion, and alcohol consumption over the last week were collected from participants at pre- and post-survey.

Results: A significant difference in pre- to post-survey mean difference of alcohol consumed per occasion was found, with those in the intervention condition displaying a larger mean decrease when compared to controls. No intervention effect was found for units of alcohol consumed per week or for CAGE scores. Sixty-three percent of intervention participants agreed that the feedback provided was useful. Those intervention participants who were above the CAGE cut off were more likely to report that the website would make them think more about the amount they drank.

Conclusions: Delivering an electronic personalised feedback intervention to students via the World Wide Web is a feasible and potentially effective method of reducing student alcohol intake. Further research is needed to replicate this outcome, evaluate maintenance of any changes, and investigate the process of interaction with web-based interventions.

Key words: alcohol, e-health, intervention, student, social norms

1. Introduction

The prevalence of alcohol misuse amongst the student population continues to be highlighted (Royal College of Psychiatrists, 2003). Of particular concern are the high levels of heavy episodic or binge drinking within the student population (e.g. White et al., 2006), and the negative effect that this has on academic performance, physical and psychological health, and anti-social and risky behaviour (Wechsler, Davenport, Dowdall, Moeykens, & Castillo, 1994; Wechsler, Lee, Nelson, & Kuo, 2002; Ham and Hope, 2003). Levels of heavy drinking during higher education have been well documented in the US (e.g. Wechsler et al., 1994). Although research in the United Kingdom (UK) has not been as wide spread or consistent, surveys of undergraduates also find high levels of alcohol consumption, with 52% of male and 43% of female students drinking above the recommended limits (Gill, 2002).

One intervention approach attracting increasing interest is that of providing personalised feedback. Brief personalised feedback intervention (PFI) programmes focus on an individual's alcohol consumption and provide personalised risk level and alcohol related information (Larimer, Cronce, Lee, & Kilner, 2004/2005; Saunders, Kypri, Walters, Laforge & Larimer, 2004; Walters & Neighbors, 2005; White, 2006). Interventions aim to tackle problems early, and there is evidence to suggest that these interventions, that emphasise reduction rather than abstinence, are efficacious with high risk drinkers (Murphy et al., 2001). The effectiveness of PFI methods has been established using written (White et al., 2006; Murphy et al., 2004), face-to-face (Borsari & Carey, 2000; White et al., 2006) mailed (Collins, Carey, & Sliwinski, 2002; Walters, Bennett, & Miller, 2000), and computer feedback (Neighbors, Larimer, & Lewis, 2004), although Walters (2000) did not find a significant reduction using the postal method at six week follow up.

Extending this, the social norms approach incorporates the use of personalised normative feedback (often alongside other intervention components) to provide corrective information about actual levels of peer alcohol consumption (Lewis & Neighbors, 2006; Neal & Carey, 2004). The tendency for overestimation of peer alcohol intake amongst the student population has been widely found (Perkins & Berkowitz, 1986), and in light of this, personalised normative feedback interventions that focus on the discrepancy between the perceived and actual levels of consumption have been developed (Agostinelli, Brown, & Miller, 1995; Neighbors et al., 2004). These personalised interventions tackle the apparent discrepancy by providing information about an individual's alcohol consumption in relation to an analysis of the group norms, and have successfully facilitated behavioural change by targeting and engaging with students who drink at high levels (Walters, 2000; Lewis & Neighbors, 2006).

However, traditional methods of providing personal feedback and motivational interventions are limited in a number of important ways. For example, interventions are limited by their reach and ability to screen a wide range of at risk groups, as recruitment can be difficult in university settings, and may be restricted to one department or school. In addition, interventions can prove costly and highly labour intensive. In response to these issues, research has started to develop web based interventions that can be completed at a time convenient for the participant, and without the need for staff to actually administer the intervention, or manually collect the data.

Accordingly, studies conducted mainly in North America and New Zealand have begun to investigate the feasibility and effectiveness of delivering personalised feedback and social norms interventions via the internet (e.g. Bendsten, Johansson, & Akerlind, 2006; Chiauzzi, Green, Lord, Thum, & Goldstein, 2005; Cunningham, Humphreys, & Koski-

Jannes, 2000; Kypri et al., 2004; Linke, Brown, & Wallace, 2004; Moore, Soderquist, & Werch, 2005; Neighbors, Lewis, Bergstrom, & Larimer, 2006). A recent review of web-based alcohol interventions conducted by Bewick et al. (in press) concluded that current evidence of the effectiveness of e-SBI is promising but inconsistent and that further controlled trials are needed to investigate their efficacy.

The current study therefore aimed to investigate the feasibility and effectiveness of an electronic feedback and social norms alcohol intervention administered to UK students in a randomised controlled trial (RCT). It was hypothesised that this intervention would decrease the units of alcohol consumed over the last week and would also decrease the number of units consumed on an average occasion. The study also aimed to examine gender differences and investigate the effectiveness of the intervention in heavy drinkers.

2. Method

2.1. Participants

Students completing a university wide student experience survey (n=3075) were asked to register their interest in participating in a study investigating student alcohol consumption. Of those who registered half were randomly selected and invited to take part in the current study (n=1075).

Previous research suggests that alcohol consumption decreases over degree course and that the number of students engaging in high levels of weekly consumption in this population are relatively low (approximately 5%) (Bewick et al., under review). Therefore based on information provided at registration participants were stratified by gender, age group, year of study, self reported weekly consumption of alcohol and randomly

assigned, using the SPSS random sampling function, to either the intervention (personalised feedback; n=539) or control (assessment only; n=536) condition. The current study reports on those participants who provided informed consent and completed pre-study data based on their own experience (n=506, 47%). Sixty-nine percent of participants were female (n=3478) and the mean age of the sample was 21.29 (SD 3.68). Of those 506 participants who completed pre-study assessments (control condition n=272, intervention condition n=234), 317 (63%) also completed post-study assessments (control condition n=179, intervention condition n=138).

2.2. Procedure

Data were collected electronically via two web sites; one for each experimental condition. Both sites included the same questions presented in the same order. Contact with all participants was by e-mail, and at each stage participants received a standardised message inviting them to participate in the study. Each message included a direct link to the appropriate web-based survey. Those who did not initially respond to the study were sent an email reminder at weekly intervals for two weeks (i.e. a maximum of 3 contact emails per time-point). All participants were informed that they would be randomly allocated to a control (i.e. assessment only) or an intervention condition. Pre-survey data were collected from control and intervention participants at week 1. Immediately after completing the pre-survey intervention participants received personalised feedback and social norms information. Those in the intervention condition received an additional invitation to visit the intervention website at week 6. Intervention participants had access to the website throughout the 12-week study period and there were no restrictions placed on the numbers of visits they could make to the site. At week 12 post-survey data were collected from control and intervention participants.

As an incentive to participate in the study, participants received university printer credits depending on their level of participation with the maximum total amount (150 printer credits valued at £1.50) being given to individuals in the intervention condition who completed the pre-, mid-, and post-surveys. Control participants who completed both pre and post surveys received a total of 100 printer credits (valued at £1.00). Those in the intervention condition could additionally access the intervention website at any time during the 12 week period and this enabled them to complete the assessment questions and receive the relevant feedback at a time that suited them. The study was approved by Leeds East NHS Research Ethics Committee.

2.3. Data collection tools

The wider study included questions regarding alcohol consumption, risk behaviour, cigarette smoking and mental health but only the questions with relevance to the current paper are discussed here. Assessments included the CAGE measure, an assessment tool that is widely utilised as a screening tool for alcohol use disorders (Ewing, 1984; Mayfield, McLeod, & Hall, 1974) with alpha values reported between 0.52 and 0.90 (Shields and Caruso, 2004). CAGE has previously been utilised within college populations (e.g. Aertgeerts et al., 2000) and consists of four items: 1) Have you ever thought about cutting down on your drinking, 2) Do you ever get annoyed at criticism of your drinking, 3) Do you ever feel guilty about your drinking, and 4) Do you ever have a drink in the morning. Scoring positively on two or more of the items indicates problem drinking.

Participants were asked to report on the average number of alcoholic drinks they usually consume per drinking occasion and how many alcoholic drinks they consumed over the last week. Participants were provided with a list of common alcoholic beverages and asked to indicate how many they had consumed within the relevant time period. This method is recommended for use within samples that consume alcohol regularly (Dawson, 2003). The number of alcoholic drinks consumed was then converted into units of alcohol consumed (1 unit = 10ml ethanol). The number of days per week that alcohol is consumed was also recorded.

After receiving their personalised feedback participants in the intervention condition were asked to respond to the following statements using a five item scale (strongly agree to strongly disagree): "I found the feedback useful", "I feel that it will reduce the amount I drink", "I would like to use the website again", "I feel it will make me think more about the amount of alcohol I drink", "I feel it will increase the amount of alcohol I drink" and "I would recommend the website to a friend".

2.4. Personalised feedback and social norms intervention

Participants in the intervention condition received feedback on their alcohol consumption and social norms information every time they visited the website and completed the online assessment. The online personalised feedback consisted of three main sections:

2.4.1. *Feedback on level of alcohol consumption:* Participants were presented with statements indicating the number of alcohol units they consumed per week, and the associated level of health risk. Statements were standardised for each risk level, and gave advice about whether personal alcohol consumption should be reduced or maintained within the current sensible levels. The number of alcohol free days was

also indicated, alongside information stating that it is advisable to have at least two per week. Statements related to binge drinking behaviour were also presented.

2.4.2. Social norms information: Personalised statements were presented that indicated to participants the percentage of students who report drinking less alcohol than them. This was calculated relative to the risk level generated in section 1 of the feedback, and the frequency of students within each risk level was taken from data collected as part an earlier university wide survey investigating aspects of student life in Leeds (Audin, Davy, & Barkham, 2003). Information was also provided about the negative effects of alcohol intake reported by students who consume alcohol within the same risk category.

2.4.3. Generic information: This provided standard advice on calculating units, the general health risks of high levels of consumption and outlined sensible drinking guidelines publicised in the UK. Tips for sensible drinking and the contact details of both local and national support services were also presented.

2.5. Data analysis

Means and standard deviations were calculated for the CAGE total score, units of alcohol consumed per week and per occasion at pre- and post-intervention and for the calculated mean difference (i.e. post- minus pre-survey). All data analysis was carried out using SPSS version 14. The data for units per week, units per occasion and mean difference were positively skewed and the dataset was transformed before analysis was conducted. The means and standard deviations reported in the text and tables are based on the untransformed data.

The effects of condition and time on units per occasion, units per week and scores on the CAGE were investigated using 2-way analysis of variance (ANOVA). Mean

difference scores for alcohol consumption were calculated and ANOVA used to examine the effects of condition and sex. The effects of completion status on pre-survey units per occasion, units per week and scores on the CAGE were investigated using MANOVA. Differences in the proportion of completers in each condition were investigated using Chi-Squared. Differences in the number of completed site visits by intervention participants above the CAGE cut off compared to those below the cut off were investigated using t-tests. Participants above the median number of visits were compared, using MANOVA, to those below the median number of visits on the following variables: units consumed per occasion, units consumed per week and CAGE total score.

Differences in the percentage of participants who were classified as heavy episodic drinkers (i.e. $\geq$ 5 units consumed per occasion for females and $\geq$6 units for males) at pre- and post-survey by condition were explored using the z-score test statistic. Mann-Whitney U was used to investigate differences in the percentage of participants providing positive feedback between those who completed the pre- survey only and those who completed both the pre- and post- surveys. Furthermore, the responses of participants who were above the CAGE cut off were compared to those below the cut off. For the majority of items a 'strongly agree' or 'agree' response was classified as positive feedback while 'unsure', disagree or 'strongly disagree' were classified as negative feedback.

3. Results

No significant differences between the control and intervention in age (t=-0.19, df=503, p=0.85), sex (χ^2=0.21, df=1, p=0.65), reported number of units per occasion (F=0.79, df=1, 504), units per week (F=2.59, df=1, 504) or total CAGE score (F=0.20, df=1, 504,

p=0.71) were found (Table 1). The mean number of units consumed during the last week was 13.83 (SD=14.61). Thirty-one percent (n=159) of participants reported weekly consumption exceeding the recommended weekly limits (i.e. 14 units for females and 21 units for males). The majority of students reported consuming alcohol on 1-3 days per week (n=305, 60%), 14% (n=70) reported consuming alcohol on 4-7 days per week and 26% (n=131) reported consuming alcohol less than once a week. The mean pre-survey CAGE score was 1.69 with 279 participants (55%) being identified as reporting high weekly levels of alcohol consumption (i.e. males>50 units/week; females>35 units/week).

3.1. Alcohol consumption

ANOVA revealed a significant difference in pre- to post-survey mean difference of alcohol consumed per occasion between conditions (F=5.74, df=1,313, p=0.02), with the intervention group displaying a larger decrease compared to the control group (see Table 2). An effect size calculation on transformed scores revealed a small effect (d=0.29, CI=0.07, 0.5). There were no significant differences for units of alcohol consumed per occasion pre- to post-intervention mean difference for sex (F=1.62, df=1,313 p=0.20) or any interaction between condition and sex (F=1.39, df=1,313, p=0.24).

There was no significant difference (z=-0.95, p=0.34) in the proportion of participants engaging in pre-survey heavy episodic drinking on an average occasion by condition (control n=236, 87% binge drinking; intervention n=196, 84% binge drinking). This difference just remained non-significant (z=1.92, p=0.05) post-survey (control n=146, 82% intervention n=100, 73%).

INSERT TABLES 1- 2 ABOUT HERE

There were no significant differences in units of alcohol consumed per week pre- to post-survey mean difference for condition (F=0.85, df=1,313, p=0.36; see Table 2). Similarly, there was no effect of sex (F=0.13, df=1,313, p=0.72) or any condition by sex interaction (F=3.43, df=1,313, p=0.07). Nor were there significant differences for pre- to post-survey mean difference for CAGE scores by condition (F=0.17, df=1,313, p=0.68; see Table 2), by sex (F=0.73, df=1,313, p=0.39) or any condition by sex interaction (F=0.02, df=1,313, p=0.88).

3.2. Frequency of visits to intervention website

Intervention participants visited the website, completed the questionnaire and received personalised feedback nearly 3 times on average (M=2.79, SD=1.26). There was no significant difference in the number of site visits by participants above (M=2.77, SD=1.20) and below (M=2.82, SD=1.34) the CAGE cut off (df=232, *t*=0.29, p=0.77). Participants below the median number of website visits (i.e. 3) reported consuming significantly more units per occasion (M=11.63, SD=9.93) compared to their above median peers (M=8.69, SD=5.06) (F=7.99, df=1, 141, p<0.01). No significant difference was found with regard to units consumed per week (F=0.45, df=1, 141, p=0.50; above M=12.09 SD= 12.89; below M=13.80, SD=12.34) or total CAGE scores (F=0.13, df=1, 141, p=0.72; above M=1.68, SD=1.11; below M=1.75, SD=1.09).

3.3. Completion status

No significant difference was found in the proportion of completers within each condition (χ^2=1.87, df=1, p=0.17). A significant difference between completion status and pre-

survey units consumed per occasion (F=13.78, df=1, 502, p<0.01) with completers reporting consuming fewer units per occasion (M=9.68, SD=6.88, n=323) than non-completers (M=11.81, SD=9.20, n=183). The difference between completion status and units consumed per week at pre-survey was also significant (F=5.69, df=1, 502, p=0.02) with completers consuming fewer units per week (M=13.03, SD=14.61) than non-completers (M=15.24, SD=14.55). No significant condition by completion status interaction was found for either units per occasion (F=0.00, df=1, 502, p=0.95) or units per week (F=0.27, df=1, 502, p=0.60). There was no significant difference with regard to CAGE total score and completion status (F=2.78, df=1, 502, p=0.10).

3.4. Participant ratings of personalised feedback

Sixty-three percent (n=85) of intervention participants agreed that the feedback was very useful but only 6% (n=8) agreed that it would reduce the amount they drink. In addition, 46% (n=60) of the sample agreed that they would like to use the website again, 53% (n=70) agreed that it will make them think more about the amount they drink, and 44% (n=58) would recommend the website to a friend. There were no effects of completion status or sex on personalised feedback ratings. Figure 1 shows that the only effect of CAGE classification was on the statement, 'It will make me think more about the amount I drink', with 63% (n=47) of those above the cut off and 40% (n=23) below the cut off agreeing (Mann Whitney U=1135.50, p=0.01).

INSERT FIGURE 1 ABOUT HERE

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4. Discussion

The current study is the first evaluation of a web-based personalised feedback and social norms alcohol intervention for students within the UK. The high numbers

expressing interest in being involved in the current study suggest that issues surrounding alcohol consumption are of relevance to UK students and that online interventions are accessible and of interest to this population. e-SBI could therefore provide a feasible method of engaging participants and providing alcohol related information.

The results suggest that this could be an effective method of reducing units of alcohol, at least that consumed per average occasion, within the student population. In line with previous work the current study suggests that the effect of the personalised feedback intervention did not differ according to sex (see Walters and Neighbors, 2005 for a review). While the current study found a significant decrease in units consumed per average occasion for those in the electronic intervention condition, no significant change was found for CAGE total score or for the number of units consumed per week. The reduction in units consumed per occasion is encouraging. Ideally, an intervention such as this should show reductions in all measures of alcohol consumption. But reducing units consumed per occasion might be considered the most achievable (and measurable) target in the first instance. Clearly, this outcome requires replication in future studies. However, further research is needed to understand the relationship between the reduction in heavy episodic drinking and maintenance of overall weekly consumption levels.

The high levels of heavy episodic drinking reported provide further evidence that the levels of alcohol consumption within the student population are a concern and warrant the development of specific intervention strategies. Despite the significant reduction in units consumed per average occasion for intervention participants, the post-survey

reported levels of engagement in heavy episodic drinking for both conditions remained high.

To date studies evaluating the effectiveness of web-based personalised feedback interventions have focussed on the impact of participants accessing the intervention on one occasion (see Bewick et al, in press; Kypri & Cunningham, in press). There is currently limited evidence available on the impact of multiple presentations of web-based personalised feedback. Within the current study intervention participants could access the web-site at any stage during the 12 week intervention period. While participants did engage with the intervention during this period, the level of engagement was relatively low with a median of 3 visits. The finding that those visiting the site more frequently reported lower pre-survey levels of consumption warrants further research. To date there is a lack of knowledge about the processes that influence a participants' decision to engage with an online intervention on multiple occasions and this is an area that would benefit from further research. There is also a need for future studies to establish levels of optimal personalised feedback frequency and, if desirable, to investigate methods of increasing the level of engagement amongst participants.

The inclusion of a sizeable proportion of students consuming alcohol at high levels is notable given that previous studies have reported engaging a larger proportion of low-level consumers (e.g. Kypri & McAnally, 2005). Furthermore, those drinking above the CAGE cut off point for problem drinking were more likely to agree that the intervention would make them think more about how much they drink. This is encouraging, as interventions need to target and encourage participation by those drinking above the recommended limits. Within the current study non-completers reported consuming significantly more units per week and per occasion than completers, and it has been

previously established that participants who drop out are generally heavier drinkers (Edwards & Rollnick, 1997). There was, however, no difference in drop out rates across the conditions, and participant feedback regarding the intervention did not differ significantly by completion status. Additionally it is encouraging that those intervention participants above the CAGE cut off did not differ significantly in terms of the number of completed visits to the site when compared to their below cut off peers.

The current study is the first RCT to evaluate web-based alcohol interventions in the U.K. This combined with the relatively large numbers of participants recruited and retained compared with previous studies in the area (see Bewick et al. (in press) for a review), particularly high-risk drinkers, means that it makes a distinct contribution to the current evidence base. However, a number of limitations need to be considered when interpreting the results. First, slightly less than two thirds of participants completed the post-survey. This level of retention is better than many comparable web-based interventions. However, it is notable that the study recruited a higher proportion of high-risk drinkers than earlier work and slightly higher attrition was found amongst higher consumers of alcohol. Whether web-based interventions are as effective with those who consume extremely high levels of alcohol is an issue for further attention. Second, using the exact recall method for measuring alcohol consumption 'over the last week' may not provide a fair reflection of the consumption habits of all participants, as drinking patterns vary due to external factors. Future studies would benefit from the inclusion of the recall of an average week's alcohol consumption alongside the last week recall. Third, as with all self report data the accuracy of recall can be questioned and previous work has suggested discrepancies between the actual and estimated amount of alcohol consumed (Kraus et al., 2005). Therefore, problems with survey data mean that quantity results must be interpreted with caution if used as an indicator of absolute levels of

consumption. Lastly, the current study included no follow-up and therefore the ability for the intervention to maintain change in alcohol consumption per occasion within the intervention group is unknown. Future study designs would benefit from including follow-up data collection to assess the long-term impact of e-SBI's.

5. Conclusion

The intervention reported on here lends support to the efficacy and potential effectiveness of using online interventions to reduce alcohol consumption per occasion amongst the UK student population. That units consumed per occasion have been reduced is encouraging but the relationship between this and weekly consumption requires further investigation. Future research should also seek to investigate how individual components of e-SBI's target each behaviour and thereby understand how components effectively target specific aspects of drinking behaviour.

Acknowledgements

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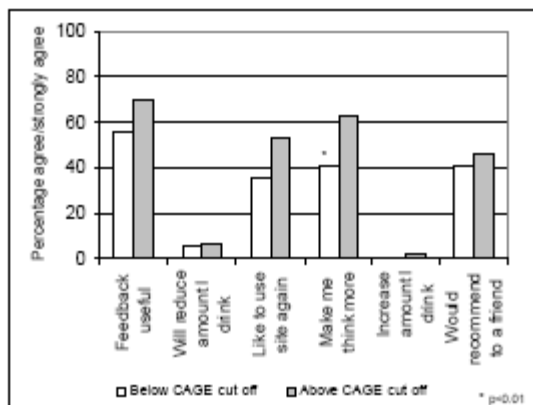Figure 1 Participant rating of website intervention by CAGE cut off

Table 1: Units per occasion, per week and CAGE total score by condition

		Control condition			Intervention condition			Overall		
		n	M	SD	*n*	M	SD	*n*	M	SD
Units per occasion[a]	*Pre-*	272	10.65	7.59	234	10.22	8.17	506	10.456	7.86
	Post-	179	9.80	7.22	138	8.46	5.68	317	9.22	6.62
Units per week[a]	*Pre-*	272	14.73	15.34	234	12.78	13.67	506	13.83	14.61
	Post-	179	14.85	18.67	138	12.02	13.58	317	13.62	16.68
CAGE total score	*Pre-*	272	1.67	1.26	234	1.71	1.14	506	1.69	1.20
	Post-	179	1.55	1.36	138	1.57	1.11	317	1.56	1.26

[a] Table presents untransformed data while analysis was carried out on transformed data

Table 2: Post- minus pre-intervention mean difference by condition

	Control condition			Intervention condition		
	n	M	SD	n	M	SD
Units per occasion [a], *	179	-0.05	3.80	138	-1.04	5.01
Units per week [a]	179	0.78	18.20	138	0.39	13.94
CAGE total score	179	-0.04	0.77	138	-0.08	0.98

[a] Table presents absolute data while analysis was carried out on transformed data
* $p=0.017$