

# Feasibility of a Fully Automated Multiple Session Alcohol Intervention to University Students, Using Different Modes of Electronic Delivery—The TOPHAT 1 Study

Bendtsen Marcus<sup>1,2</sup>, Bendtsen Preben<sup>1</sup>

<sup>1</sup>Department of Medicine and Health, Linköping University, Linköping, Sweden; <sup>2</sup>Department of Computer and Information Science, Linköping University, Linköping, Sweden.  
Email: marcus.bendtsen@liu.se

Received August 14<sup>th</sup>, 2013; revised September 5<sup>th</sup>, 2013; accepted September 12<sup>th</sup>, 2013

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## ABSTRACT

**Background:** In recent years more and more electronic health behaviour interventions have been developed in order to reach individuals with an unhealthy behaviour such as risky drinking. This is especially relevant in university students who are among those who most frequently are risky drinkers. This study explored the acceptability and feasibility, in an unselected group of university students, of a fully automated multiple session alcohol intervention offering different modes of delivery such as email, SMS and Android. **Material and Methods:** A total of 11,283 students at Linköping University in Sweden were invited to perform a single session alcohol intervention and among those accepting this (4916 students) a total of 24.7% accepted to further participate in the extended multiple intervention lasting 3 - 6 weeks. The students could choose mode of delivery, total length of the intervention (between 3 - 6 weeks) and number of messages per week (3, 5, or 7 per week). A follow-up questionnaire was applied after the intervention to which 82.7% responded. **Results:** most students wanted to receive the messages by email with the shortest intervention length (3 weeks) and as few messages as possible per week (3 messages). However, no major difference was seen regarding satisfaction with the length and frequency of the intervention despite chosen length and frequency. Most students also expressed satisfaction with the content of the messages and would recommend the intervention to a fellow student in need of reducing drinking. **Discussion and Conclusion:** Based upon feedback from the students, a multiple push-based intervention appears to be feasible to offer additional help for those who have interest after a single session alcohol intervention. In a forthcoming study we will further explore the optimal mode of delivery and length of intervention and number of messages per week.

**Keywords:** Excessive Alcohol Drinking; University Students; Fully Automated Intervention; Health Behavior Change

## 1. Introduction

Alcohol continues to be a widely spread reason for a number of health problems, predominantly among young people [1]. Time and again more than 50% of students in Sweden are measured to have drinking habits that classify them as risky drinkers [2-5]. Although brief face-to-face interventions delivered in various health care settings have been shown to be effective, the implementation has been poor [6,7].

The expansion of access to electronic devices with network communication capabilities has prompted a new approach for reaching individuals with behaviour change interventions. In a review (based upon 85 studies of In-

ternet based health behaviour change interventions) the effects on health behaviour varied across behaviours and studies, and were on average small. Additional effects were enhanced by adding short message service (SMS) to other kinds of Internet based interventions [8].

Web-based interventions, *i.e.* where a person is guided to a web page with reflective information, exercises and home work to be done before logging in at a later stage, has shown to be difficult to implement. Not least in the area of alcohol interventions [9].

As part of their routine practice 90% of student health-care centres in Sweden are using a proactive Internet-based screening system with brief and normative feedback [2,3,5]. The student healthcare centres use a web-

based portal to send an invitation via email to all students enrolled at the university. In the email there is a link that takes the willing participant to a short questionnaire and once all questions have been answered and processed a personalized and normative feedback is given. This kind of brief intervention (often referred to as *fully automated single session intervention*) has been shown to have a positive outcome on risky drinkers [10-15]. The method has been compared to other forms of interventions (individual and group face-to-face, pen-and-paper screening) and shown to be as effective and cost less to implement [16].

However, the effect size of alcohol interventions, both delivered face-to-face or via the Internet is small and the numbers needed to treat in order to get one risky drinker to reduce drinking below safe limits is 10. Consequently a large group of individuals that receives a brief Internet based intervention continue to drink at levels that are considered risky. Therefore more development and research is needed in order to optimize existing interventions and develop new means of communicating health behaviour change in order to accomplish an effect on a population level.

Using simple proactive messages, delivered via SMS or email, has been used successfully in trials where consideration has been taken to smoking habits [17], physical activity [18] and weight loss [19]. Although slightly different in their nature, the main component of the interventions has been messages delivered continuously during a set time period. The method of using mobile phone messaging for changing health behaviour has shown great promise, e.g. one of the more recent trials, *txt2stop* [17], was found to significantly improve smoking cessation rates at 6 months. A number of reviews have also highlighted the advantage of using text messaging as a tool for behaviour change support [20-23]. So far, only a few inconclusive attempts have been made in order to evaluate the feasibility and effectiveness of SMS interventions in comparison to other means of communicating such as email and apps [23].

Simple messages have been used in some settings within the field of brief alcohol interventions. In one setting SMS messages were used to improve alcohol diary keeping as part of a self-assessment of consumption [24]. Similarly SMS messages have been used to assess and give feedback to participants in an attempt to reduce heavy drinking among young people seeking care at an emergency department [25]. Besides these two studies, there is a lack of research using simple messages or emails as the main component of an intervention aimed at reducing alcohol consumption to non-risk levels. One limitation of the two existing studies has been sample size and recruitment methods. The intervention design in this study uses a more proactive approach, inviting everybody from

a student population, not only treatment seekers.

The present study evaluates the feasibility of an innovative proactive approach of extending an initial single session Internet based alcohol intervention with a new extended multiple session intervention (delivered by SMS, email or an Android app) to those participants that are curious or motivated for more help to decrease their alcohol consumption.

The objective of the study is to evaluate the feasibility and user satisfaction of this new extended intervention when applied to university students. Furthermore the study is a pilot of the developed software prior to a planned larger scale RCT.

## 2. Methods

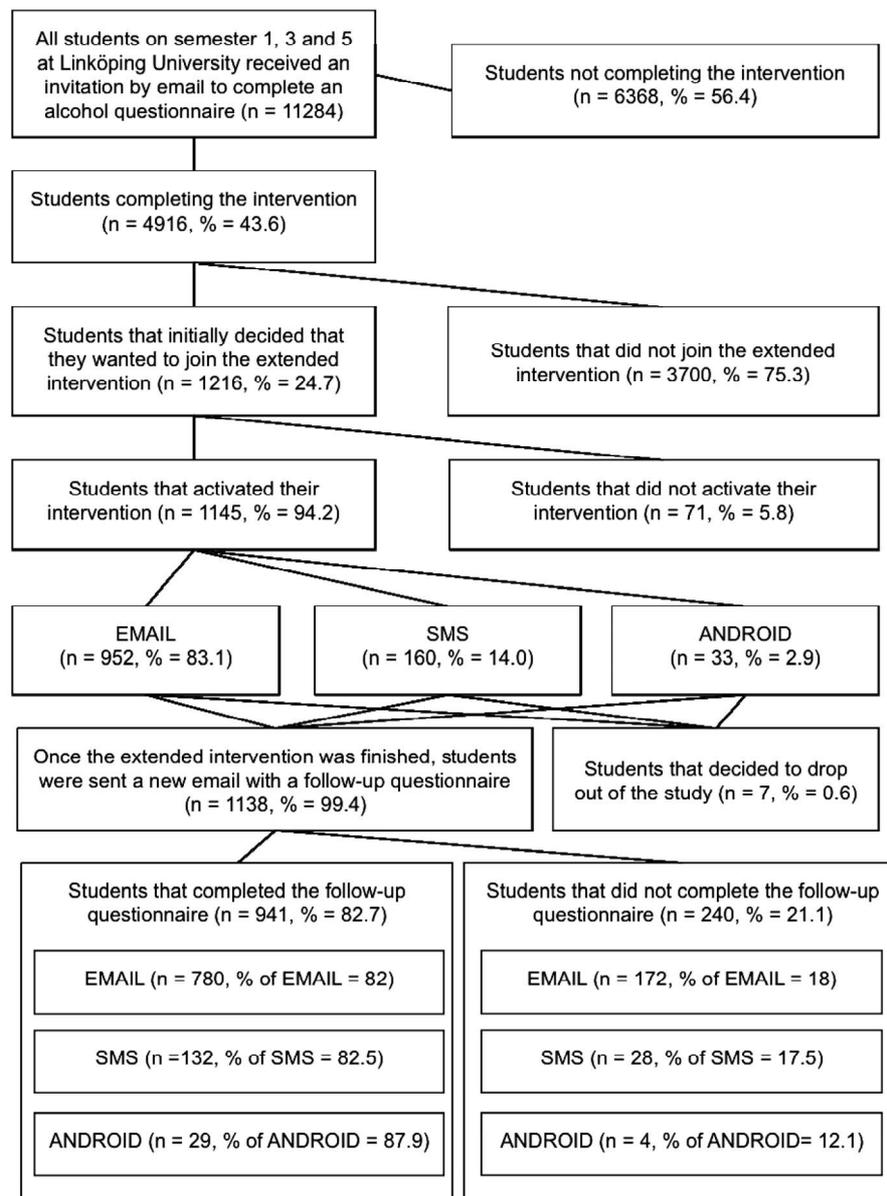
### 2.1. Population and Recruitment

All students starting their 1<sup>st</sup>, 2<sup>nd</sup> or 3<sup>rd</sup> year at the Linköping University (a total of 11,283 students) were, in mid-October 2012, invited via their official university email address to complete a fully automated Internet based alcohol single session intervention by clicking on an embedded link in the email. The contents of the email and single session intervention was the same as is used during routine practice at Universities around Sweden as reported previously [26], with additional information regarding the option of being able to join a research project after having received the usual 3-pages of feedback from the single session intervention. After 1 and 2 weeks, a reminder was sent to those who had not completed the single session intervention, and after 3 weeks the questionnaire was closed and no more responses were accepted. The students completed the single session on a computer/smartphone/tablet at their own convenience.

Students having completed the single session intervention were offered to be included in a draw of an iPad if they were willing to participate in an extended intervention as part of a research project. This also included answering a follow-up questionnaire after having completed the extended intervention. All students, regardless of alcohol consumption, were offered to join the research project and participate in the extended intervention. No other means of registering to the study or the extended intervention was made available. An overview of the recruitment process and study design is shown in **Figure 1**.

### 2.2. Signing up and Completion of the Extended Intervention

Participants that were willing to join the study after the single session intervention were given three options. First they choose their preferred delivery method, the choices



**Figure 1.** Flowchart of recruitment process of participants and design of the study.

were email, SMS or Android. Secondly they choose the number of weeks they would like to receive messages (3, 4, 5 or 6 weeks). Lastly they selected the number of messages they wanted to receive per week (3, 5 or 7 messages per week).

Since the participants were invited via email to complete the single session intervention no further steps were necessary for those who choose email, as we already had their email address from the initial invitation. For those who choose SMS, a code was presented on the screen as well as a phone number. Participants had to send an SMS to the phone number containing the code. This allowed us to verify the participants phone number as well as keeping track of their answers during the single session.

Participants who choose to use an Android app were instructed how to download the application, and once downloaded and installed they had to activate the application with a code shown on screen.

Once these steps were complete the intervention ran for the selected number of weeks. When the last message was sent to a particular participant the system sent an email to them. The email contained a link to a questionnaire with follow-up questions.

### 2.3. Content of the Extended Intervention

The new extended intervention consists of text messages delivered to participants at a specific time during the

week. The method of delivery varies depending of personal choice, including email, SMS (Short Text Messaging) and delivery to custom-made smartphone applications. The delivery of messages goes on for a specified number of weeks as decided beforehand by the individual participants.

Based upon prevailing theories within the field of behaviour change, including: *Self-Determination Theory*, *Social Cognition Models*, *Social Cognitive Theory*, *Theory of Planned Behaviour* and *Model of Action Phases*, textual content for the messages was created. The content of the messages were labelled as “food for thought”, “task”, “facts”, “reflective” or “challenges”. A schedule was created for when to send what type of message during the week. An example of a “food for thought” messages is: “*What are the most important things in your life? How does drinking affect them?*” An example of a “task messages” is: “*List three good things and three not so good things about your drinking*”. An example of a “fact messages” is: “*Alcohol influences your sleeping negatively. You might fall asleep quickly after drinking but wake up earlier than usual not being able to fall asleep again. This could lead to more chronic sleeping disturbance if you often drink excessive*”. An example of a “reflective messages” is: “*Is the way that you drink fully in accordance with your own values?*” An example of a “challenge messages” is: “*Tonight or next time you are going out for a drink—decide to take a glass a water between every drink*”. *This will make you feel better the next day—and you will probably save some money.*

## 2.4. Extended Intervention Messages Schedule

Based upon the chosen number of messages per week at signup a delivery schedule was created for each participant. There were three possible schedules depending on the choice of 3, 5 or 7 messages per week. These possibilities are presented in **Figure 2**. If a student choose 3 messages per week they would receive a message with “food for thought” content on Wednesdays a message with a “challenge” of Fridays and a message with “reflective” content on Sundays.

## 2.5. Measurements

### 2.5.1. Risky Drinking at Baseline

Risky drinking was defined according to the official

definition used in Sweden that includes two criteria: the total weekly consumption and frequency of heavy episodic drinking (HED).

Risky total weekly consumption of alcohol was defined as drinking more 9 (females) or 14 (males) standard units per week (1 standard unit = 12 g of alcohol, e.g. a small glass of wine). Heavy episodic drinking was defined as drinking more than 4 (females) or 5 (males) standard units on a single occasion, e.g. during an evening. Having one or more episodes of heavy drinking per month was considered risky drinking. Participants were considered risky drinkers if they fulfilled either or both of the above definitions. These drinking limits for safe drinking are the official limits as used in Sweden.

### 2.5.2. Perceived Drinking Compared to Peers at Baseline

Students were asked if they think they drank more, less or the same as their peers as part of the assessment in the single session intervention. This was used in the analysis of the feasibility evaluation of the extended intervention. In the single session feedback the students were graphically shown a comparison between their actual consumption compared with peers in the same age group and sex. The comparison was based on a reference database held by the authors from the previous 5 years of surveys completed throughout Sweden, consisting of more than 150.000 measurements on students.

### 2.5.3. Follow-Up Questionnaire

The follow-up questionnaire contained 10 questions exploring the feasibility and usefulness of the extended intervention as perceived by the students. Two questions explored whether the student had changed their alcohol consumption and reasons for a reduction of the consumption. (*Analysis not included in his study since it was only a feasibility study*). One question explored whether the student had any problems signing of for the SMS or email delivery method or downloading the Android application. Two questions explored satisfaction with the chosen length of the intervention period with the following response options: *too long/just right/too short/don't know* and numbers of messages with the following response options: *too many/just right/too few/don't know*.

One question explored the students overall perception of the content of the messages with the following re-

Messages per week	Mon	Tue	Wed	Thu	Fri	Sat	Sun
7	FFT	Task	FFT	Task	Challenge	Challenge	Reflection
5	FFT		FFT		Challenge	Challenge	Reflection
3			FFT		Challenge		Reflection

**Figure 2. Delivery schedule for messages.**

Sponse options: *very good/good/poor/very poor*. Three questions explored the students' perception of the usefulness of three different themes or categories of messages (motivating, facts and challenges) with the following response options: *great use/some use/almost no use/don't know*. The last questions asked whether the student would recommend the intervention to a friend that drinks too much with the following response options: *yes definitely/possibly/doubtful/don't know*. The participants could also comment their responses to each question.

The study was approved by the Regional Ethical Committee in Linköping, Sweden, No. 2012/255-31.

## 2.6. Statistical Analysis

Differences between students within different response options to the questions in the follow-up questionnaire were examined using chi-square tests. All data from the single session and from the sign up were used to characterize students. In some cases cell values were too small for reliable chi-square output. Pooling was done for these variables, as well as an attempt at using Fisher's exact test. Only tests where  $p < 0.05$  were considered. All statistics were performed using R version 2.15.1.

## 3. Results

### 3.1. Response Rate and Characteristics of Participants

Among the 11,284 students who were invited to participate in the first step of the study 43.6% completed the single session intervention and received feedback. The initial single session intervention was sent to all students starting their 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> years at the University of Linköping, using the official university mailing list, and therefore we did not know the age, sex and social status of the total population of the 11,284 students invited to participate. However the proportion of students participating in the single session intervention were fairly similar comparing the different years with a slightly lower response rate for first-year students on 41% compared with 45% for students in years 2 and 3. The characteristics of the responders to the single session intervention providing baseline data are shown in **Table 1**.

Among the 4916 students that answered the baseline survey and thus were invited to sign up for the extended intervention 1216 (24.7%) choose to sign up. The characteristics of those who signed up are seen in **Table 2**. Male participants were significantly more likely to sign up for the extended intervention than females (28% versus 22%). Those reporting that they had a partner were also more likely to join the extended intervention (26% versus 24%). Participants that reported that they were

**Table 1. Characteristics of participants that participated in the single session baseline intervention (n = 4.916).**

University year	n (%)
1	1957 (39.8)
2	1665 (33.9)
3	1294 (26.3)
<b>Sex</b>	
Female	2630 (53.5)
Male	2286 (46.5)
<b>Age</b>	
18 - 20	1454 (29.6)
21 - 25	2735 (55.6)
26 - 30	427 (8.7)
31+	300 (6.1)
<b>Motivation to change</b>	
I have tried to decrease my consumption, but failed	35 (0.8)
I am thinking about how to change my habits	203 (4.6)
I have thought about changing, but I'm not thinking about it right now.	549 (12.3)
I have started decreasing my consumption	989 (22.2)
I have not had any thoughts regarding change	2683 (60.2)
<b>Risky drinking</b>	
No risk	1803 (36.7)
Risky drinking	3113 (63.3)

thinking about changing their alcohol consumption or that they had taken action towards changing their consumption were also more likely to join the intervention (28% versus 24%). However, there were no difference in the proportion of risky drinkers and non-risky drinkers that signed up for the extended intervention.

Although the numbers of students that initially decided that they wanted to join the extended intervention were 1216, a number of students choosing SMS or Android did not manage to activate the method of delivery. In total, 62 (28.3%) of participants that choose SMS did not activate the intervention or choose another delivery method. The point of failure activating the SMS intervention was the step that required participants to send an SMS with a specified code to a specified phone number.

Thus the number of participants that managed to activate their choice of delivery method was 1138, with 952 students (83.1%) choosing email, 160 (14%) choosing SMS and 33 (2.9%) choosing the Android application.

**Table 2. Characteristics of students enrolled in the extended intervention (n = 1.216).**

	Enrolled n (%)	Not enrolled n (%)	$\chi^2$ (df)	p-value
<b>Sex</b>				
Female	576 (21.9)	2054 (78.1)		
Male	640 (28.0)	1646 (72.0)	24.08 (1)	<0.0005
<b>Age</b>				
18 - 20	350 (24.1)	1104 (75.9)		
21 - 25	67 (24.7)	2059 (75.3)		
26 - 30	121 (28.3)	306 (71.7)		
31+	69 (23.0)	231 (77.0)	3.81 (3)	0.2832
<b>Social status (pooled data)</b>				
No partner	684 (23.7)	2207 (76.3)		
Have a partner	532 (26.3)	1493 (73.7)	4.22 (1)	0.0398
<b>Perceived drinking compared to peers (pooled data)</b>				
More	138 (24.0)	437 (76.0)		
Same	337 (23.8)	1082 (76.2)		
Less	728 (25.6)	2114 (74.4)	2.03 (2)	0.3619
<b>Motivating to change (pooled data)</b>				
No thoughts of change	642 (24.0)	2041 (76.0)		
Thought of change	212 (28.2)	540 (71.8)		
Taken action	264 (25.8)	760 (74.2)	6.04 (2)	0.0489
<b>Risk drinking</b>				
No risk	455 (25.2)	1348 (74.8)		
Yes risk	761 (24.5)	2352 (75.5)	0.34 (1)	0.5591

A total of 941 follow-up questionnaires were returned giving a total response rate of 82.7%. The response rate was 81.9% for the email group, 82.5% for the SMS group and 87.9% for the Android group (**Figure 1**). All questions had to be completed so there were no internal missing data on any questions.

### 3.2. Choice of Delivery Methods

The choice of delivery method did not differ between the different semesters, sex, age or social statuses, but those students that thought they drank somewhat more than their peers (n = 128) choose significantly more often SMS as the mode of delivery (28% versus 20%,  $\chi^2 = 15.62$  (df 4), p = 0.0036). Students who were thinking about changing their consumption significantly more often choose the SMS mode of delivery (26% versus 15%,  $\chi^2 = 15.34$  (df 4), p = 0.004) compared with stu-

dents not considering changing their consumption. Risk drinkers were not more likely to initially sign up for a specific delivery method.

### 3.3. Choice of Length of the Intervention and Frequency of Messages

The choice of the length of the intervention (possible options were 3, 4, 5 or 6 weeks) is seen in **Table 3**. In total 51% of the participants choose a 3 week intervention, 16% choose 4 weeks, 5% choose 5 weeks and 28 % choose a 6 week intervention. Students on their first year at the University and age group 26 - 30 more often choose a 6 week intervention. Those who choose SMS or Android as the mode of delivery more often signed up for a 6 week intervention. There were no significant difference concerning choice of delivery methods between male and female students, social status (living with or

**Table 3. Choice of length of the intervention in relation to semester, age and delivery method and frequency of messages.**

University year	Choice of length of intervention period				$\chi^2$ (df)	p value
	3 weeks	4 weeks	5 weeks	6 weeks		
1	246 (48.4%)	82 (16.1%)	24 (4.7%)	156 (30.7%)	13.31 (6)	0.0383
2	226 (56.9%)	59 (14.9%)	13 (3.3%)	99 (24.9%)		
3	150 (48.2%)	57 (18.3%)	22 (7.1%)	82 (26.4%)		
<b>Age, n (%)</b>						
18 - 20	195 (55.7%)	56 (16%)	15 (4.3%)	84 (24%)	17.30 (9)	0.0442
21 - 25	347 (51.3%)	108 (16%)	38 (5.6%)	183 (27.1%)		
26 - 30	47 (38.8%)	25 (20.7%)	3 (2.5%)	46 (38%)		
31+	33 (47.8%)	9 (13%)	3 (4.3%)	24 (34.8%)		
<b>Delivery method chosen, n (%)</b>						
ANDROID	17 (34%)	9 (18%)	5 (10%)	19 (38%)	12.93 (6)	0.0441
EMAIL	506 (53.4%)	150 (15.8%)	43 (4.5%)	248 (26.2%)		
SMS	99 (45.2%)	39 (17.8%)	11 (5%)	70 (32%)		
<b>Frequency, n (%)</b>						
3-a-week	593 (56.1%)	170 (16.1%)	51 (4.8%)	243 (23%)	141.73 (6)	<0.0005
5-a-week	13 (19.4%)	21 (31.3%)	7 (10.4%)	26 (38.8%)		
7-a-week	16 (17.4%)	7 (7.6%)	1 (1.1%)	68 (73.9%)		

without a partner and having children), perceived drinking compared to other students, motivating to change consumption and risk drinking status.

Concerning the choice of *frequency of messages* [the options were 3, 5 or 7 a week] the majority, 87% choose to receive 3 messages per week and 6% choose 5 per week and 7% choose 7 messages per week. Students on their first year, males, and students perceiving that they drank more than their peers also more frequently choose 7 messages per week. It is seen in **Table 4** that those participants who signed up for SMS and Android more frequently wanted 7 messages per week than those who choose email as the mode of delivery.

### 3.4. Satisfaction with the Chosen Length of the Interventions Period

Around 3% of the participants thought that the intervention chosen was too long independently of the chosen length of the intervention period. The majority, 77%, found the length “just right” whereas 14% found the intervention length too short and 6% could not decide. Risky drinkers significantly more often found the intervention to be too short than non-risk drinkers (17% versus 9%,  $\chi^2 = 22.16$  (df 3),  $p = 0.0001$ ) as well as those who choose SMS compared with email (18% versus 13%,

$p = 0.0066$ , Fischer’s exact test). A few, 3.6% of those who choose email perceived the intervention too long compared to none in both the SMS and Android group. No difference was seen in satisfaction with chosen length of the intervention period and year, sex, age, social status (living with or with a partner and having children) or chosen frequency of messages per week.

### 3.5. Satisfaction with the Chosen Number of Messages per Week

Most participants, around 70% - 80%, were satisfied with the chosen numbers of messages per week. However, significantly more students among those who had chosen 7 messages a week perceived the messages to be too frequent (26%) compared to those who had chosen 3.

a) Fishers exact test (13%) or 5 (21%) per week. There were no differences in satisfaction with the frequency of messages concerning sex, age, social status (living with or without a partner and having children) or motivation to change at baseline. Students on their third year, risky drinkers and those that perceived they drank more than their peers were more prone to think that the numbers of messages were too few (**Table 5**). Participants who choose email and Android as the mode of delivery more often thought that the frequency of messages was too

**Table 4. Choice of frequency of messages in relation to other parameters.**

Choice of frequency of messages					
University year	3-a-week	5-a-week	7-a-week	$\chi^2$ (df)	p value
1	421 (82.9%)	37 (7.3%)	50 (9.8%)		
2	357 (89.9%)	19 (4.8%)	21 (5.3%)	13.59 (4)	0.0087
3	279 (89.7%)	11 (3.5%)	21 (6.8%)		
<b>Sex, n (%)</b>					
Female	517 (89.8%)	28 (4.9%)	31 (5.4%)	8.74 (2)	0.0126
Male	540 (84.4%)	39 (6.1%)	61 (9.5%)		
<b>Perceived consumption compared to peers (Pooled), n (%)</b>					
More	105 (76.1%)	11 (8%)	22 (15.9%)		
Same	298 (88.4%)	17 (5%)	22 (6.5%)	18.51 (10)	0.0010
Less	644 (88.5%)	37 (5.1%)	47 (6.5%)		
<b>Delivery method chosen, n (%)</b>					
ANDROID	35 (70%)	8 (16%)	7 (14%)		
EMAIL	850 (89.8%)	40 (4.2%)	57 (6%)		< 0.0005 <sup>a)</sup>
SMS	172 (78.5%)	19 (8.7%)	28 (12.8%)		
<b>Intervention length chosen weeks, n (%)</b>					
3 weeks	593 (95.3%)	13 (2.1%)	16 (2.6%)		
4 weeks	170 (85.9%)	21 (10.6%)	7 (3.5%)		
5 weeks	51 (86.4%)	7 (11.9%)	1 (1.7%)	141.73 (6)	NA
6 weeks	243 (72.1%)	26 (7.7%)	68 (20.2%)		

Fishers exact test.

high (Table 5).

### 3.6. Perceived Satisfaction with the Content of the Messages

Most participants (92.2%) found the overall content of the intervention to be “good” or “very good”. The perceived satisfaction did not differ between participants from the three different years, nor between age groups, motivation to change, risky drinking status, mode of delivery, length of chosen intervention or frequency of messages. But females (96% versus 90% for men) and those living with a partner (4% versus 91% without a partner) was in general more positive concerning the content.

In the follow-up questionnaire we asked the participants to consider the usefulness of three different groups of messages that we thought the students would be able to distinguish; “motivating”, “facts” and “challenges”.

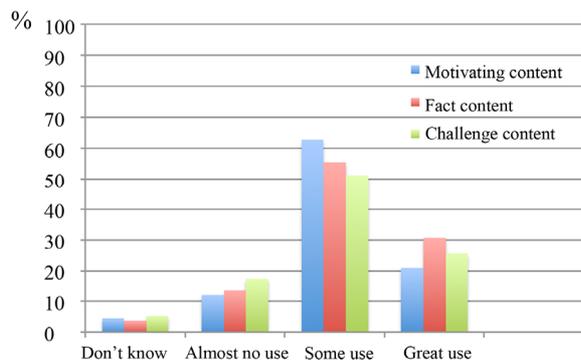
We asked the students to think of a student that needs to reduce his/hers drinking. The results are displayed in Figure 3 and few significant differences were seen between the groups of students. However, the participants that choose SMS were significantly more satisfied with the *motivating messages* compared with the two other means of delivery (30% satisfied compared to around 20% for email and Android,  $\chi^2 = 13.6$  (df 6),  $p = 0.043$ ). Also, participants choosing a 6 week intervention was significant more satisfied (“great use”) with the *fact messages* compared to participants choosing a shorter duration of the intervention (40% compared with 26% - 34%,  $\chi^2 = 26.79$  (df 9),  $p = 0.0015$ ). Risky drinkers were less prone to agree that the *challenge messages* were of “great use” than non-risky drinkers (23% versus 30%,  $\chi^2 = 12.24$  (df = 3),  $p = 0.0066$ ).

Lastly, we asked the students whether the participants would recommend the intervention to a friend that was in

**Table 5. Satisfaction with chosen frequency of messages.**

	Satisfaction with the frequency of messages n (%)				$\chi^2$ (df)	p value
	Too many	Just right	Too few	Don't know		
<b>University year</b>	57 (15.0)	312 (81.9)	6 (1.6)	6 (1.5)	15.01 (6)	0.0201
1	46 (14.6)	240 (76.2)	14 (4.4)	15 (4.8)		
2	33 (13.5)	194 (79.2)	13 (5.3)	5 (2.0)		
3						
<b>Perceived consumption compared to peers (Pooled data)</b>					0.0007 <sup>a)</sup>	
More	9 (9.1)	81 (81.8)	6 (6.0)	3 (3.0)		
Same	26 (9.5)	228 (83.5)	13 (4.8)	6 (2.2)		
Less	99 (17.7)	431 (77.0)	14 (2.5)	16 (2.9)		
<b>Risk drinking</b>					25.17 (3)	<0.0005
No risk	72 (20.3)	264 (74.4)	5 (1.4)	14 (3.9)		
Risk	64 (10.9)	482 (82.3)	28 (4.8)	12 (2.0)		
<b>Activated delivery method</b>					0.0448 <sup>a)</sup>	
Android	7 (24.1)	19 (65.5)	2 (6.9)	1 (3.5)		
EMAIL	119 (15.3)	615 (78.8)	24 (3.1)	22 (2.8)		
SMS	10 (7.6)	112 (84.8)	7 (5.3)	3 (2.3)		
<b>Frequency of messages</b>					0.0167 <sup>a)</sup>	
3 per week	107 (13.0)	663 (80.8)	28 (3.4)	23 (2.8)		
5 per week	11 (21.2)	35 (67.3)	74 (7.7)	2 (3.9)		
7 per week	18 (26.4)	48 (70.6)	1 (1.5)	1 (1.5)		

<sup>a)</sup>Fishers exact test.



**Figure 3. The participants' perception of the usefulness of the different messages, thinking on a student that needs to reduce drinking (n = 941). Response to the question: "How useful do you think the different categories of messages would be for a student that drinks too much?"**

need of cutting back on the alcohol consumption and around 33.4% would definitely recommend the intervention, and 46.4% would possibly recommend it whereas 18.6% was doubtful and 1.6% did not know. Female participants, non-risky drinkers, those who choose a 6 week intervention or SMS were more likely to recommend the intervention to a friend. The greatest difference was seen with regards to the chosen length of the intervention;

where 27% of those who had chosen a 3 week intervention indicated that they definitely would recommend a friend to use the intervention compared with 42% among those who had chosen a 6 week intervention ( $\chi^2 = 25.3$  (df 9),  $p = 0.0027$ ). No difference was seen between the participants choosing different frequency of messages a week.

#### 4. Discussion

The study aimed to explore the feasibility of offering an extended alcohol intervention to students having performed an Internet based single session alcohol intervention. This is the first explorative study in a series of planned studies, the TOPHAT studies (Trial and Optimisation of Push based High Alcohol Treatment) that has been proposed in order to find an optimal length and content of proactive extended alcohol intervention to university students. Others and we have previously reported a modest effect of a single session alcohol intervention delivered by mail and although this effect is in parity with a short person-to-person intervention there is a need for more effective interventions [11,16,26].

We therefore hypothesized that a certain proportion of students with risky drinking identified by a single session

intervention are willing to sign up for a proactive extended intervention for a number of weeks in contrast to just offering access to a web site. However we do not know the feasibility of such an offer with regards to how long time this extended intervention preferable should be and how many messages per week is perceived to be optimal by the target group. Our approach is a fully automated intervention based upon push techniques, which means that the participants do not have to log-on to a website but receives the messages/intervention at certain predefined times. This stands in contrast to most previous Internet based alcohol interventions where the participants had to remember to log-on to a web site, which has shown to have very low compliance [9].

The response rate to the initial single session intervention was 43.6%, which is somewhat higher than in our previous studies [3,5,10]. One possible reason for this could be that we were offering all participants to be included in a draw of an iPad. We decided to include such an incitement in order to get as many participants in this explorative study as possible. We had expected the sign up rate for the extended intervention to be somewhat higher, having in mind the possibility to win an iPad, but we still managed to include nearly 25% of those who had performed the single session intervention. We stressed that both risky and non risky drinkers could sign up for the extended intervention since we wanted as many views as possible on the structure and content of the extended intervention. Therefore somewhat less than one third of the participants in the evaluation of the extended intervention were non-risky drinkers (**Table 2**). However the proportion of participants signing up for the extended intervention was surprisingly equally distributed with regards to all baseline characteristics (**Table 2**). In a naturalistic or routine administration of the extended intervention we would expect less students to sign up for more help although this might vary between groups of students and universities and still has to be tested in forthcoming TOPHAT studies.

The follow-up rate was as high as 82.7 and somewhat better than expected from previous studies. Whether this reflects the possibility to win an iPad or a genuine interest in furthering the development of an extended intervention is difficult to know, but we believe that many students are concerned about the alcohol culture at the universities and therefore probably have an interest in participating.

#### 4.1. Choice of Delivery

The choice of delivery of the extended intervention was somewhat surprising since most students (83.1%) choose email. One reason for this could be that the single session

was delivered by an email and the students thought it was convenient to continue getting emails. Whether email is an optimal means of delivering an extended push based intervention will be explored in coming TOPHAT studies, exploring when a message are read and if it is read. We can plan a SMS for example on a Friday evening and if the message is delivered by SMS this might be read immediately, but if it is an email this might not be read as intended before going out on a pub. Although smartphones have narrowed the difference between SMS and email, most individuals might still be more prone to read a SMS when it arrives, rather than a new email. However, we got some indication that SMS was more often chosen by students who perceived their consumption to be more than peers and by students who were thinking about reducing their consumption. Whether this is an indication that SMS would be the best choice for individuals in an action phase of changing consumption is difficult to conclude from the feasibility study.

#### 4.2. Choice of Length and Frequency of Messages

We wanted to explore what choices students would make if given a choice concerning the length of the intervention and frequency of messages. Although the majority of the students choose the shortest duration of the intervention with the least number of messages per week, we still saw that 27% wanted a 6 week intervention. These students more often choose SMS as the mode of delivery indicating the feasibility of offering a longer intervention by this mode of delivery. Concerning the frequency of messages 87% choose 3 per week, but those who wanted more frequent messages were characterized as students that perceived to drink more than their peers and choosing SMS as the mode of delivery. This indicates that a subgroup of students might want and perhaps benefit from more frequent messages. Still, it is impossible to conclude what would be the optimal length of an extended intervention and optimal number of messages per week from the choices made by the students. But, when looking at satisfaction with the choices the students made we had assumed that we would be able to see a clarifying pattern in order to decide the length of the intervention and frequency of the messages in a forthcoming TOPHAT 2 study. However, despite the chosen length of the intervention (3, 4, 5 or 6 weeks), less than 5% thought that the intervention was too long. Also, the majority thought that the frequency of messages were “just right” independent of choice. Still, students having asked for 5 or 7 messages per week were more prone to think that it was too many. Thus, it appears that most students were able to make a choice that fitted with their perceived needs and interest but a forthcoming TOPHAT 2 study will clarify satisfaction with an extended intervention

were all students gets the same length of an extended intervention and the same number of messages per week.

### 4.3. Perceived Perception of the Messages

Overall the messages were perceived as good or very good by the participants (**Figure 2**). In an attempt to explore whether there were any different opinions about the usefulness of the motivating, facts or challenge messages we found a fairly similar satisfaction with all three groups of messages. Somewhat surprising, risky drinkers were less satisfied with the challenges indicating either a lack of motivation or poorly formulated challenges. Only a few students were doubtful to recommend the extended intervention to a friend but surprisingly more students having chosen a longer intervention expressed an interest in recommending the intervention. This indicates a somewhat more perceived usefulness having participated in a longer intervention.

### 4.4. Study Limitations

The study was performed in an unselected group of students primarily not seeking help for their alcohol consumption including both risky and non-risky drinkers. We also introduced a bias when offering the participants to be included in a draw of an iPad. However, from previous studies we know that this helps us getting a sufficient number of participants, which we decided would be acceptable in this first explorative study. This means that the results should be taken with some reservations. In a non-treatment seeking population it is natural to select as few messages per week and as short intervention as possible whereas in a treatment seeking population we would have found a somewhat different picture. Still, the purpose of this first study was to get an idea what is feasible to expose students to in order to get a good compliance since we assume that both single session and extended interventions always will meet individuals with a strong motivation as well as less strong motivation and preferable should satisfy both groups. In a forthcoming TOPHAT 2 study we will change the study design and randomize students to either SMS or email excluding the choice of an Android app since this was chosen by so very few. In this forthcoming study all students will receive a 4-week intervention with 4 messages per week. Using the same follow-up questionnaire we will explore differences in answers when not having the options to choose mode of delivery. We will also explicitly explore if and when a message was read in order to be able to insure correct timing of challenges *i.e.* before going to the pub on a Friday evening.

### 5. Conclusions

This study aimed at exploring the interest in signing up

for an extended alcohol intervention in an unselected student population that had participated in a single session alcohol intervention. About 25% of the students signed up and gave information about what would constitute an optimal extended intervention in their opinion, keeping in mind that both risky and non-risky drinkers were included. Thus in the present research context including both risky and non risky drinkers most participants preferred email, but students who perceived they drank more than their peers more often preferred SMS. Most students wanted a fairly short, 3-week, intervention, with as few messages (three) as possible per week. These findings might be due to selection bias since the participants were participating in a draw of an iPad if they joined the study. Still, students choosing a lengthier intervention were just as satisfied with the length than those who had chosen a shorter intervention time. However, students who received 7 messages per week were more prone to perceive the messages to be too many. Overall the students found the content of the various messages to be good, or very good. Overall the results from the present study will be valuable in further development of the software to be tested in upcoming studies with fewer choices, but based upon the same content. The sign-up problems with the SMS will also have to be sorted out in the new version of the software with a different sign-on procedure to be implemented.

Based upon the feedback from the students, an extended push based intervention appears to be feasible to offer those interested in additional help after a single session intervention, which is also underlined by the large proportion of the students that would recommend the intervention to a friend who was in need of cutting down on drinking.

In a forthcoming TOPHAT 2 study we will further explore the optimal mode of delivery and length of intervention and number of messages per week before performing a larger effectiveness

### 6. Acknowledgements

Statistician Nadine Karlsson is thanked for her valuable help with the statistics

### 7. Conflict of Interest

Both authors own shares in and work in a private company that develops and distribute mobile health interventions.

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