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Reach and effectiveness of a computer-based alcohol intervention in a Swedish emergency room

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Abstract
Objectives: This study evaluates a computerized alcohol intervention implemented in a Swedish emergency department (ED) with regard to the effectiveness of two different types of tailored brief feedback on patients' drinking patterns and the reach of the intervention.
Methods: The study was a prospective, randomized controlled trial of ED patients. The designated target population was the ED population aged 18–69 years who registered at the triage room before receiving care. Patients who were categorized as risky drinkers and completed the computerized test were randomized to either a long or a short feedback. The feedback was tailored on the basis of the individual patient's responses to questions on their drinking patterns.
Results: The computerized intervention reached 41% of the target population. Those who completed the computerized test and received the feedback were younger than those who did not receive the intervention. Among those who could be followed up, the feedback was effective in reducing the patient's weekly alcohol consumption and the number of heavy episodic drinking occasions. The long feedback was slightly more effective than the short feedback, but the differences were not statistically significant.

Introduction

Alcohol consumption in Sweden has increased substantially over the last decade, reaching its highest levels in 100 years. Between 1996 and 2004, consumption increased from 8.8 L of 100% alcohol per year per person (over 15 years) to 10.4 L. Since then, consumption has stabilized at about 10 L per year per person (Andréasson and Allebeck,

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2005). The alcohol consumption trends in Sweden have led to concern as to whether the number of alcohol-related emergency department (ED) presentations might be on the increase. Patients presenting to EDs have higher weekly consumption and more frequently engage in heavy episodic drinking (HED) than the general population (Cherpitel, 1999, 2007; Peters et al., 1998; Nordqvist et al., 2006). The ED setting thus offers an important opportunity to intervene with patients to reduce future alcohol intake (Babor and Kadden, 2005; Cryer, 2005). The ED has often been described as ''an ideal setting in which to identify and initiate interventions for alcohol abuse'' (Maio, 1995, p. 221) and being ''ideally situated for alcohol screening, interventions, and referrals'' (Daeppen, 2003, p. 495).

Despite the ED's potential as an important venue for alcohol interventions, emergency care patients are rarely assessed for alcohol use (Graham et al., 2000; Rhodes et al., 2001; Barnett et al., 2003; Neumann et al., 2004). This can be partially explained by the operational difficulties of delivering alcohol interventions in the ED environment, which tends to be busy and overcrowded. Lack of time, fear of negative patient response due to the perceived sensitivity of the subject, negative attitudes to and lack of interest in alcohol prevention, and insufficient knowledge about alcohol-related issues have been cited as key obstacles for implementation of alcohol interventions in ED settings (Hadida et al., 2001; Wallace, 2001; Charalambous, 2002).

Although empirical support is emerging for computerized health behaviour interventions, very few studies have evaluated the effectiveness of computer-based alcohol interventions delivered in ED settings. We have only been able to identify two such studies (Blow et al., 2006; Neumann et al., 2006). This paucity of research suggests that more studies are needed to explore the use of computerized interventions implemented in ED settings. Effectiveness is obviously a critical aspect, but it is also important to consider the reach of computer-based interventions in terms of the proportion and representativeness of patients who are willing to participate in such interventions. The public health impact is a function of effectiveness and reach (Heather et al., 1996; Glasgow et al., 2006). This paper fills a knowledge gap by evaluating a computerized alcohol intervention implemented in a Swedish ED with regard to its reach and the effectiveness of two different types of tailored feedback on patients' drinking patterns.

Methods

Study design, setting and population

The study was a prospective, randomized controlled trial of ED patients, conducted over a 1-year period at the ED facility of the Motala County Hospital, beginning in March 2007. The population of Motala is 42,000. Motala County Hospital is a public hospital with a total catchment area of approximately 80,000 people (SCB, 2007). Swedish health care is publicly funded, i.e. residents are insured by the state and health care services are funded through a taxation scheme of the county councils. Approval and permission to conduct this study were given by an ethical committee.

Study participants were eligible if they were aged 18–69 years. Patients were excluded for the following reasons:

- Structural reasons: arrived by ambulance or received immediate care without presenting to the triage room.
- Health reasons: the triage nurses considered the patients to be too ill, injured, intoxicated or fragile to do the computerized test.
- Feasibility reasons: the triage nurses perceived ''logistical'' problems such as many patients presenting within a short time period or the ED waiting room being crowded.

The remaining patients comprised the designated target population: patients who *should* be given a card by the ED triage nurses with an instruction to do the computerized test.

The computerized intervention concept was designed to require minimal input by the researchers. The amount of time the researchers devoted to maintaining the intervention did not exceed 2 h/week over the 1-year study period. The implementation of the concept is described in detail in a previous study (Nilsen et al., 2009).

Procedure

Patients who were registered at the ED triage room were given an instruction card by a triage nurse and requested to answer alcohol-related questions on a touch-screen computer that was positioned in the adjacent ED waiting room. Participation was voluntary and the patient could exit the computer programme at any point. Patients who completed the programme received a one-page printout, containing either a long or a short feedback on their drinking patterns and motivation to change drinking behaviour. The patient picked up the printout by the computer and it was not available to any of the staff. No further person-to-person feedback was provided.

Using a randomization algorithm within the computer programme, patients were allocated to one of two types of feedback. The ''long feedback'' group received tailored advice and information concerning the weekly alcohol intake level, frequency of heavy episodic drinking (HED), and motivation to change current drinking patterns. The printout also included a graphic illustration of a traffic light, indicating the patient's weekly alcohol consumption and frequency of HED, represented as ''hazardous level'', an ''elevated risk'' or ''no risk''. The advice, information, and traffic lights were tailored based on the patient's answers. The ''short feedback'' group received only the graphic illustration showing the risk levels regarding their weekly alcohol consumption and frequency of HED. The decision to use two different types of feedback was based on the ED staff's wishes to provide feedback to *all* patients who did the computerized test. A similar methodology was also used in one of the previous computer-based ED studies (Blow et al., 2006).

At the end of the computer programme, the patients were asked if they would be willing to respond to a follow-up postal questionnaire. The follow-up questionnaire

was mailed 6 months after the ED visit. Two reminders were sent.

Data sources

Several different sources were used to obtain data for this study. ED logs provided data on the total number of patient's aged 18–69 years presenting to the ED during the study period. Baseline data were collected through the computer, which stored participant-provided information in a database. This made it possible to access socio-demographic and alcohol consumption information about the participants and to examine the number of tests initialized and completed. Follow-up data were collected by means of a postal questionnaire that was mailed to the patients 6 months after their ED visit. Questions on the patient's alcohol consumption since the ED visit were included in the questionnaire.

Individual interviews were conducted with five triage nurses and one group interview was conducted with a further five triage nurses to obtain information on the different types of patients presenting to the ED who did not initialize the computer test, i.e. estimates of how many patients were excluded due to structural, health or feasibility reasons. After the study was over, the number of ''instruction cards'' remaining was counted to obtain a measure of how many patients were not given a card by the triage nurses.

Variables

The following data were recorded on the computer: (a) socio-demographic data on sex, age, education, and occupation; (b) data on three drinking variables: frequency of drinking, typical quantity of drinking, and frequency of HED. The data on drinking variables were also recorded in the follow-up questionnaire.

Frequency of drinking was measured as follows: every day; almost every day; 3–4 times per week; 1–2 times per week; 2–3 times per month; about once per month; less often than monthly; had not been drinking during the past year. Typical quantity of drinking was measured as follows: 1 standard glass; 2–3 standard glasses; 4–5 standard glasses; 6–7 standard glasses; 8–9 standard glasses; 10 standard glasses or more. One standard drink equals 12 g of pure alcohol.

Responses regarding frequency of drinking and typical quantity were combined to calculate the weekly consumption for each patient, according to a method suggested by Seppä et al. (1995), whereby a person drinking 1–2 times per week (counted as two times per week) and a typical quantity of 4–5 standard glasses (counted as drinking five standard glasses) has a weekly consumption of 10 standard glasses.

HED was defined as consuming four drinks or more on one occasion for women and five drinks or more on one occasion for men. This standard is widely applied in the international literature on alcohol (Dawson et al., 2005; Reinert and Allen, 2007). Frequency of HED was categorized as follows: never; less than monthly; about once per month; 2–3 times per month; 1–2 times per week; 3–4 times per week; almost every day or every day. To estimate the number of HED occasions per month, we applied the same principle of using the highest amount in an interval.

Risk drinking was defined as having a weekly consumption of 10 or more drinks for women ($\geqslant$120 g) and 15 or more ($\geqslant$180 g) for men (i.e. hazardous weekly consumption) and/or engaged in HED (as defined above) once a month or more often. This composite risk drinking definition has been promoted by the National Public Health Institute and is widely applied in Sweden (Andréasson and Allebeck, 2005). Those who drank at above these levels of weekly consumption and/or frequency of HED are referred to as risky drinkers in the text.

Outcomes

Three outcome measures were used:

(1) Participation was examined in terms of the proportions of patients who initialized and completed the computerized test, were willing to be followed up 6 months later, and responded to the follow-up questionnaire.
(2) Representativeness was examined by comparing age and sex for patients who initialized but did not complete the computerized test with those who completed the test. Representativeness was also investigated by comparing socio-demographic and alcohol data for those who were unwilling to be followed up with a questionnaire (non-participants), those who did not respond to the follow-up questionnaire (non-responders), and those who responded to the follow-up questionnaire (responders).
(3) Effectiveness was measured by comparing the long and short feedback conditions in terms of absolute and relative changes, from baseline to follow-up, in weekly alcohol consumption (in grams) and number of HED occasions per month, and the proportion of patients who changed from risk drinking to non-risk drinking levels, according to the previously stated composite definition.

Data analysis

Pearson's χ^2-test and Fisher's exact test, when appropriate, were used to analyse the differences in distribution regarding socio-demographic characteristics (Tables 1 and 2), type of feedback (Table 1), and proportion of risky drinkers (Table 3). Differences in average weekly consumption were tested with one-way ANOVA (for all three categories in Table 1) and *t*-test (all tables). Differences concerning frequency of HED occasions per month between the two types of feedback were tested with non-parametric tests, the Kruskal–Wallis test (for all three categories in Table 1) and the Mann–Whitney test (all three tables). In Table 3, absolute change in consumption within each feedback condition was tested with the paired *t*-test (average weekly intake) and with the non-parametric Wilcoxon signed-rank test (number of HED occasions per month). A *p*-value <0.05 was considered statistically significant. SPSS 15.0 was used for the statistical calculations.

Table 1 Socio-demographic and drinking characteristics of the three categories.

	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 = 0.823)						
Male	268 (65)		33 (64)		57 (61)	
Female	147 (35)		19 (37)		36 (39)	
Total	415 (100)	0.879	52 (100)	0.859	93 (100)	0.552
Age, years (p = 0.011)						
18—29	157 (39)		31 (57)		42 (45)	
30—39	70 (16)		9 (17)		16 (17)	
40—49	70 (17)		4 (8)		20 (22)	
⩾50	118 (28)		8 (15)		15 (16)	
Total	415 (100)	0.014	52 (100)	0.146	93 (100)	0.079
Education (p = 0.267)						
Low education	119 (29)		15 (29)		19 (21)	
High education	296 (71)		37 (71)		74 (79)	
Total	415 (100)	1.000	52 (100)	0.308	93 (100)	0.122
Occupation (p = 0.155)						
Student	43 (10)		10 (19)		15 (16)	
Employed	267 (64)		33 (64)		60 (65)	
Unemployed	38 (9)		6 (12)		7 (8)	
Other	67 (16)		3 (6)		11 (12)	
Total	415 (100)	0.066	52 (100)	0.569	93 (100)	0.363
Type of feedback (p = 0.197)						
Long	198 (49)		29 (60)		52 (56)	
Short	206 (51)		19 (40)		41 (44)	
Total	404 (100)	0.169	48 (100)	0.720	93 (100)	0.251
Weekly consumption, g/week (p = 0.123)						
Median (range)	72 (502)		81 (495)		63 (477)	
Mean (SE)	96.3 (4.3)	0.170	114.7 (15.1)	0.072	83.2 (8.4)	0.189
Frequency of HED, no. of HED occasions/month (p = 0.009)						
Median (range)	3 (25)		3 (24)		3 (16)	
Mean (SE)	4.5 (0.2)	0.412	5.6 (0.8)	0.014	3.0 (0.3)	0.005

[a] Non-participants, risky drinkers who completed the computerized questionnaire but answered that they not were willing to respond to the follow-up questionnaire.
[b] Non-responders, risky drinkers who completed the computerized test and were willing to be followed up, but chose not to respond to the questionnaire.
[c] Responders, risky drinkers who completed the computerized test, wanted to be followed up and answered the follow-up questionnaire.

Table 2 Baseline socio-demographic and drinking characteristics according to type of feedback.

	Long feedback, *n* (%)	Short feedback, *n* (%)
Gender (p = 0.521)		
Male	30 (58)	27 (66)
Female	22 (42)	14 (34)
Total	52 (100)	41 (100)
Age (p = 0.970)		
18–29	23 (44)	19 (46)
30–39	10 (19)	6 (15)
40–49	11 (21)	9 (22)
⩾50	8 (15)	7 (17)
Total	52 (100)	41 (100)
Education (p = 0.302)		
Low education	13 (25)	6 (15)
High education	39 (75)	35 (85)
Total	54 (100)	43 (100)
Occupation (p = 0.769)		
Student	10 (19)	5 (12)
Employed	33 (64)	27 (66)
Unemployed	4 (8)	3 (7)
Other	5 (10)	6 (15)
Total	52 (100)	41 (100)
Weekly consumption, g/week (p = 0.330)		
Median (range)	45 (429)	72 (468)
Mean (SE)	75.9 (10.8)	92.5 (13.1)
Frequency of HED, no. of HED occasions per month (p = 0.344)		
Median (SE)	3 (7)	1 (16)
Mean (SE)	3.0 (0.3)	3.1 (0.5)

Results

Participation

Fig. 1 describes the participation and reasons for attrition from the study. According to the ED log, 6864 patients aged 18–69 years were registered at the ED before receiving care during the 1-year study period. Of these, 3016 patients were not given a card with an instruction to use the computer due to structural, health or feasibility reasons. The remaining 3848 patients comprised the target population for the study, i.e. patients who *should* be given a card with an instruction to do the computerized test.

Of the target population, 1508 patients (39% of the target population) were lost due to oversight by the nurses to give the patients the card with the request to do the computerized test. An additional 278 patients (7% of the target population) were given the card but chose not to participate. The test was initialized by 2062 patients and was completed by 1570 patients, constituting 41% of the target population.

The 1570 patients who completed the computerized test were randomized to receive either the long or short feedback. Of those who completed the test, 560 patients (36%) were categorized as risky drinkers. However, 415 (74%) of those who completed the test did not want to be followed up. The remaining 145 patients (26%) were followed up with a questionnaire. Ninety-three patients replied to the questionnaire, yielding a response rate of 64% for the follow-up questionnaire.

A number of patients were excluded from the study. One patient who completed the test died within 6 months and was thus excluded. We could not obtain the addresses of four patients (they were included in the non-participants group as we had baseline data for them). One patient submitted a follow-up questionnaire that had been filled in by another person (the patient was treated as a non-responder since we had relevant baseline data). One patient was excluded because we lacked information about which type of feedback the patient had received. We also excluded 20 patients because they reported a weekly consumption that was three times higher than the cut-off for risky drinkers.

Representativeness

In total, 492 patients initialized the computerized test but did not complete it. This group of patients was to a greater

Table 3 Effectiveness of the two types of feedback.

	Long feedback (*n* = 52)	Short feedback (*n* = 41)	*p*-Value
Average weekly consumption (g) at baseline, mean (median)	76 (45)	92 (72)	0.330
Average weekly consumption (g) at follow-up, mean (median)	51 (27)	69 (72)	0.100
Absolute change in average weekly consumption, g (*p*-value)	−26 (0.029)[a]	−24 (0.039)[b]	0.940
Relative change in average weekly consumption, %	−34	−26	
Number of HED occasions per month at baseline, mean (median)	3.0 (3.0)	3.1 (1.0)	0.344
Number of HED occasions per month at follow-up, mean (median)	1.8 (0.5)	2.1 (1.0)	0.081
Absolute change in no. of HED occasions per month (*p*-value)	−1.2 (<0.001)[c]	−1.0 (0.115)[d]	0.120
Relative change in no. of HED occasions per month, %	−40	−33	
Changed from risk to no risk, %	56	39	0.144

[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.

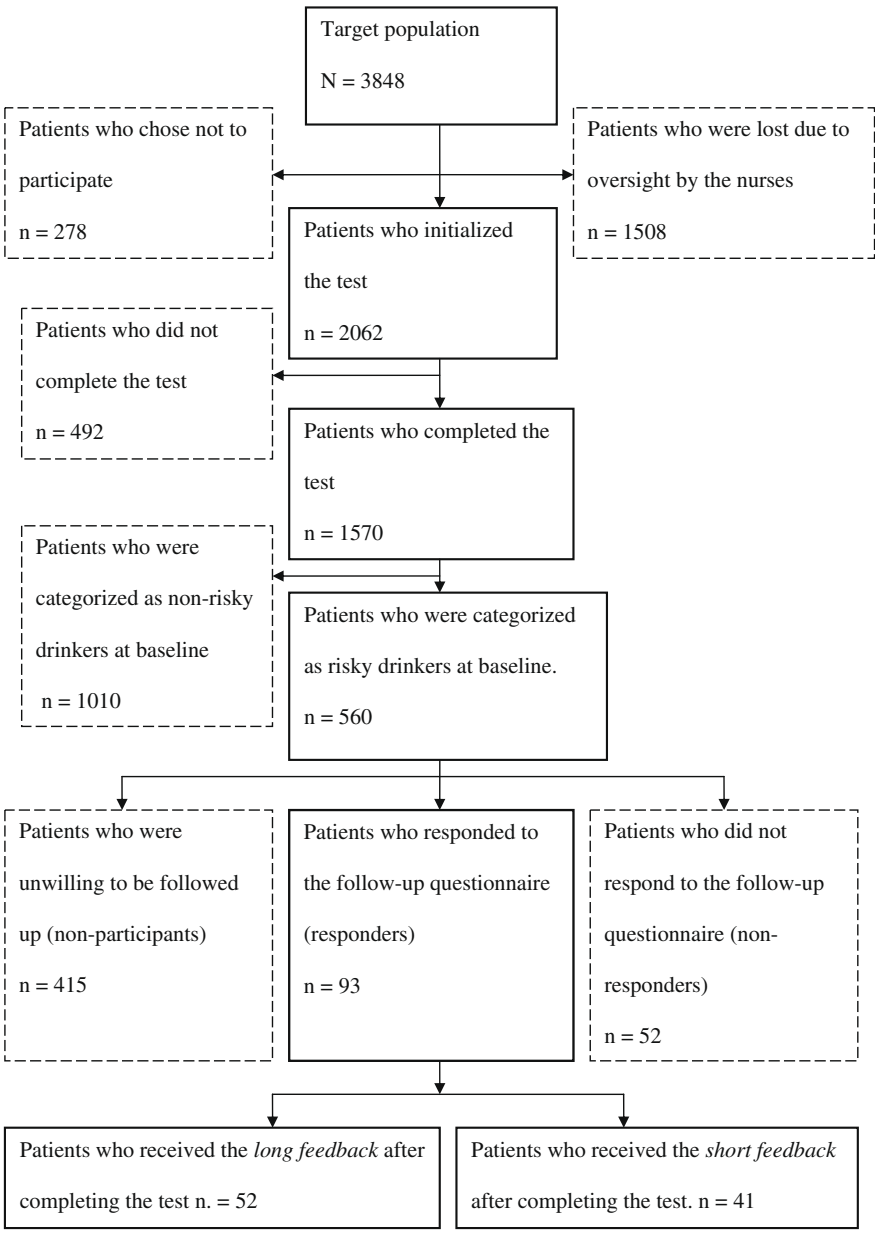

Figure 1 Participation flow-chart.

extent older, 44 versus 41 years ($p = 0.004$), than those who completed the test ($n = 1570$). Both groups were comprised of 55% women.

Table 1 presents key data on the three categories who completed the test: non-participants, non-responders, and responders. There were statistically significant differences in age between non-participants and non-responders ($p = 0.014$); the non-participants were older. However, there were no significant differences in sex, education or occupation between the three categories.

There were no significant differences between the three groups regarding weekly alcohol consumption ($p = 0.123$), but the number of HED occasions per month differed significantly between the groups ($p = 0.009$). Responders had a lower number of HED occasions per month than non-responders ($p = 0.014$) and non-participants ($p = 0.005$).

Effectiveness

Table 2 compares characteristics for the patients who received the long and short feedback. There were no statistically significant differences between the two feedback conditions concerning socio-demographic and drinking characteristics at baseline.

Table 3 presents the results concerning the effectiveness of the two types of feedback, i.e. changes from baseline to the 6-month follow-up. No significant differences were observed between the long and short feedback pertaining to weekly consumption at baseline ($p = 0.330$) or follow-up ($p = 0.100$). Patients who received the long feedback decreased their weekly consumption by 26 g between baseline and follow-up (34% reduction), which was statistically significant ($p = 0.029$). Patients who received the short feed-

back also improved, reducing their weekly consumption by 24 g between baseline and follow-up (26%), which was also statistically significant ($p = 0.039$).

There were no statistically significant differences between the long and short feedback regarding the frequency of HED at either baseline or follow-up. Patients who received long feedback reduced their frequency of HED by 1.2 occasions per month (40% reduction) between baseline and follow-up, which was significant ($p < 0.001$). Patients who received the short feedback reduced their HED frequency by 1.0 occasions per month (33% reduction), which was not statistically significant ($p = 0.115$).

The proportions of risky drinkers at baseline who changed to non-risky drinkers at follow-up did not differ significantly ($p = 0.144$) between the long and the short feedback. Of the patients who received the long feedback, 56% of the risky drinkers at baseline became non-risky drinkers at follow-up. The corresponding figure for patients who received the short feedback was 39%. In total, 48% of the target population became non-risky drinkers at follow-up.

Discussion

This study set out to evaluate a computerized alcohol intervention implemented in a Swedish ED with regard to reach in terms of the proportion and representativeness of patients who participated in the intervention, and the effectiveness of two different types of tailored computer-generated feedback on patients' drinking patterns. The intervention was integrated into ordinary ED practice and required little maintenance, thus adhering to requirements on realistic models for alcohol interventions described in the literature (e.g. Rodriguez et al., 1995; Charalambous, 2002; Barnett et al., 2003; Hungerford, 2005).

The reach of the intervention was acceptable. The test was completed by two-fifths (41%) of the target population, i.e. patients who *should* have been given a card with an instruction to do the computerized test. Unquestionably, this proportion is smaller than in most conventional alcohol intervention studies, even though the loss of patients in such studies tends to vary a great deal and is not always reported in sufficient detail to allow for comparisons among studies (Edwards and Rollnick, 1997). Obviously, higher participation rates can be achieved by applying more researcher-supported procedures, e.g. with researchers on hand in the ED to encourage patients to initialize the test and even help them complete the test. However, the present concept was implemented with the intention of being sustained with minimal researcher input in order to study its effectiveness and reach under realistic conditions.

Relatively few patients who received a card with a request to do the computerized test declined to participate. Our ''refusal rate'' of 7% of the target population compares favourably with many ED intervention studies (e.g. Forsberg et al., 2000; Maio et al., 2000; Johnston et al., 2002; Crawford et al., 2004; Neumann et al., 2006), in which attrition due to patient refusal typically ranges from about 15% to 35%. The fact that nearly nine out of ten patients who received the ''instruction card'' chose to initialize the test could possibly be seen as an indicator of patient interest in computerized assessments.

Three-quarters of the patients who initialized the test completed it and received the tailored feedback. Those who completed the test were younger than those who did not complete the test. Of those patients who completed the test, the responders (those who responded to the follow-up questionnaire) had somewhat less detrimental drinking patterns than non-participants (those who did not want to be followed up) and non-responders (those who did not respond to the follow-up questionnaire), with responders having a significantly lower number of HED occasions per month. Our findings are in line with previous brief alcohol intervention studies (e.g. Wallace et al., 1988; Richmond et al., 1995; Littlejohn, 2006; Beich et al., 2007), which have found that patients who do not want to be followed up after an intervention tend to drink more than those who are followed up.

The computer-based intervention was effective in reducing the weekly alcohol consumption and number of HED occasions per month for patients in both feedback conditions who could be followed up. The long feedback was slightly more effective than the short feedback, but the difference was not statistically significant. The decrease in weekly alcohol consumption and number of HED occasions per month from baseline to 6-month follow-up ranged between 26% and 40% for the two types of feedback. These beneficial effects are largely consistent with the large body of literature on brief face-to-face alcohol interventions. There is a solid evidence base that supports the effectiveness of brief alcohol interventions at reducing hazardous and harmful alcohol consumption in non-dependent, non-treatment-seeking patients in a variety of settings, including the ED environment (Nilsen et al., 2008).

Only two previous computer-based ED studies have been conducted. Neumann et al. (2006) conducted a study in a German university hospital ED. They found that patients who received the computer-based intervention reduced their weekly alcohol consumption by 36% from baseline to 6-month follow-up; weekly consumption in the control group decreased by 20%. A study by Blow et al. (2006), set in an American university hospital ED, combined computer-based feedback with face-to-face advice under four conditions: generic feedback complemented with brief advice, generic feedback without the advice, computer-generated feedback that was tailored according to the patient's responses complemented with brief advice, and tailored feedback without the advice. The feedback consisted of a booklet printed by the computer for each participant. The tailored and generic booklets were identical in length, content, and graphics, but the generic version included standard text and graphics rather than content tailored to the individual responses. Patients in the tailored feedback and brief advice condition achieved a 48% decrease in weekly alcohol consumption from baseline to 12-month follow-up; for the other conditions, reductions of between 26% and 36% were achieved. The corresponding reductions in HED occasions per month ranged from 20% to 37%.

Our findings suggest that the computerized intervention could have considerable public health impact, if sustained. The reach and effectiveness of the intervention must be considered very promising, but further research is needed before firm conclusions can be drawn concerning the viabil-

ity of computer-based interventions implemented in ED settings. Research on computer-assisted health behaviour interventions in general has indicated that computer solutions may have several advantages over conventional face-to-face counselling. For instance, the use of computers has been found to decrease the effect of social desirability and increase the amount of information disclosed (Robinson and West, 1992; Thomas et al., 1997; Tate et al., 2001). Findings also suggest that patients prefer to reveal information of a personal and potentially embarrassing nature to a computer than a person (Locke et al., 1992; Tourangeau and Smith, 1996). The use of computer-generated interventions can also achieve improved consistency of interventions and closer matching of intervention to patient characteristics and recommended guidelines (Noell and Glasgow, 1999).

This study has a number of obvious shortcomings and limitations that must be considered when interpreting the results. We used self-reports of alcohol use. Although self-reports are widely assumed to have reasonable validity (Midanik, 1982; Babor and Kadden, 2005), several factors influence these self-reports, such as the measuring instrument, the types of questions, and how they are administered (Del Boca and Darkes, 2003; Gmel and Rehm, 2003). The questions on frequency and typical quantity of drinking and frequency of HED were based on the Alcohol Use Disorders Identification Test (AUDIT-C). This instrument has been validated and is considered to be a good measurement for alcohol consumption (Bradley et al., 1998; Dawson et al., 2005). It is very difficult to determine the extent to which underreporting may have occurred and whether a study set in Sweden produces greater bias than studies conducted elsewhere.

Regression-to-the-mean effects are often offered as an explanation for favourable intervention effects, i.e. extreme scores on any measure at one point in time will, for purely statistical reasons, probably have less extreme scores the next time they are tested (Fleming and Graham, 2001). Another reason could be Hawthorne effects, i.e. unintended reactivity to study conditions by study participants, with a resulting effect on perceived socially desirable behaviour (Adair, 1984). Thus, awareness that one's drinking is being monitored may induce motivational effects and actual behaviour change. However, it would seem plausible that Hawthorne effects are smaller when using computer technology than face-to-face interventions. However, regression-to-mean and Hawthorne effects cannot be ruled out in our study. There are also a number of other possible explanations for the positive results seen in our study. However, the mechanisms of change involved in brief alcohol interventions are not fully understood and there is no cohesive theory to explain why these interventions work or fail (Nilsen et al., 2008). There is a need for more research to explore process factors that may influence intervention outcomes, including investigations into how screening and assessment reactivity may promote behaviour change.

Conflict of interest statement

The authors have no conflicts of interest to declare.

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