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## Accepted Manuscript

The effectiveness of web-based interventions designed to decrease alcohol consumption – a systematic review

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**The effectiveness of web-based interventions designed to decrease alcohol consumption – a systematic review.**

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**Abstract**

*Objective:* To review the published literature on the effectiveness of web-based interventions designed to decrease consumption of alcohol and/or prevent alcohol abuse.

*Method:* Relevant articles published up to, and including, May 2006 were identified through electronic searches of Medline, PsycInfo, Embase, Cochrane Library, ASSIA, Web of Science and Science Direct. Reference lists of all articles identified for inclusion were checked for articles of relevance. An article was included if its stated or implied purpose was to evaluate a web-based intervention designed to decrease consumption of alcohol and/or to prevent alcohol abuse. Studies were reliably selected and quality-assessed, and data were independently extracted and interpreted by two authors.

*Results:* Initial searches identified 191 articles of which 10 were eligible for inclusion. Of these, five provided a process evaluation only, with the remaining five providing some pre- to post-intervention measure of effectiveness. In general the percentage quality criteria met was relatively low and only one of the 10 articles selected was a randomized control trial.

*Conclusion:* The current review provides inconsistent evidence on the effectiveness of electronic screening and brief intervention (eSBI) for alcohol use. Process research suggests that web-based interventions are generally well received. However further controlled trials are needed to fully investigate their efficacy, to determine which elements are key to outcome and to understand if different elements are required in order to engage low and high risk drinkers.

**Key Words:** Alcohol; Brief Interventions; Web-Based; Personalized Feedback; Systematic Review.

## Introduction

Brief interventions for health problems such as alcohol use disorders have been of growing interest over the last few decades (Moyer et al., 2002). Several reviews have been conducted on the effectiveness of face-to-face brief interventions in health care and treatment settings (Moyer et al., 2002; Bien et al., 1993). Results are consistent, showing that brief interventions are more effective than no counseling (Bien et al., 1993).

Personalized feedback is often incorporated into brief interventions and aims to encourage behavior and/or attitude change. Studies suggest that incorporating social norms information into feedback interventions can help decrease alcohol consumption, encouraging participants to become more aware of the level and consequences of their drinking and how their drinking behaviors compare to others of a similar social or demographic group (White 2006; Walters and Neighbors, 2005; Neighbors et al., 2004; Collins et al., 2002;).

Although brief feedback interventions for alcohol use have traditionally been delivered by more conventional face-to-face (e.g., Humpreys and Klaw, 2001; Borsari and Carey, 2000) and postal mail methods (e.g., Collins et al., 2002; Walters et al., 2000; Agostinelli et al., 1995), they have more recently been delivered electronically via computer programs (e.g. Neighbors et al., 2004; Matano et al., 2000) and the internet (e.g., Davies-Kirsch and Lewis, 2004; Saitz et al., 2004; Kypri et al., 2003; Cunningham et al., 2000). Both experimental and review studies comparing a combination of such methods have found that providing feedback as an intervention for alcohol use can be effective regardless of the delivery mode (e.g. White et al., 2006; Kypri et al., 2005; Walters and Neighbors, 2005).

Although delivery mode does not impact on the effectiveness of feedback interventions, the widespread and growing availability of the internet does present an opportunity for broad dissemination and improved access to interventions (Cunningham et al., 2005; Copeland and Martin, 2004). Nielson//NetRatings global trends data from 2002 show that as many as 79% of Americans, 72% of Australians and 68% of the UK population have access to the internet with access figures continuing to rise (Steyn and Chan, 2003). Furthermore research shows that there is potentially a sizable demand for internet-based interventions for substance use (Saitz et al., 2004; Cloud and Peacock, 2001; Cunningham et al., 2000). It is also suggested that

internet based interventions may have a number of advantages over the more traditional modes of delivery. Specifically, they are able to reach a large audience in a cost effective manner (White, 2006; Walters et al., 2005), can offer participants privacy and anonymity through the ability of users to access the intervention at times and in locations that suit their needs, and are flexible in their ability to provide automated and tailored information (Moyer and Finney, 2004/2005; Fotheringham et al., 2000).

Currently information on the feasibility, utility and effectiveness of web-based interventions is limited (Evers et al., 2005; Ritterband et al., 2003). The majority of studies to date have focused their work on the feasibility of various interventions for substance use and alcohol problems in particular (e.g. Moyer and Finney, 2004/2005; Collins et al., 2002; Bein et al., 1993). Previously published reviews which have included information on web-based interventions for alcohol use have either provided only narrative accounts of the results, descriptions of the interventions with limited details on outcome results, and/or have not designated web-based interventions as their primary focus (e.g. Walters et al, 2005; Copeland and Martin, 2004). Non-systematic reviews have concluded that computer generated personalized feedback can be effective in reducing alcohol consumption (e.g. White, 2006; Kypri et al., 2005), although these reviews have not included systematic appraisal of the effectiveness of web-based interventions.

Furthermore, it should be recognized that the few research studies that have concentrated on the quality of web-based interventions have found that many interventions lack the basic elements needed for health behavior change (Evers et al., 2005). Many e-health web-sites require improvements to ensure that issues of quality, accuracy of information and efficacy are more adequately addressed (Evers et al., 2005, Kunst et al., 2002). Research also highlights the on-going problem of access to the internet, particularly for those in socially or linguistically disadvantaged cultures who do not have the resources or ability to access the interventions, Neuhauser and Kreps (2003) refer to these issues as the 'broadband divide' which may restrict many people from accessing features of e-health communication.

Given that health behavior change using the internet is still in the early stages of development (Evers et al., 2005) and that there is current interest in using this technology for alcohol use

interventions, it is timely that a systematic review focusing on the effectiveness of web-based alcohol interventions should be carried out.

To summarize, this paper provides a systematic appraisal of the best available evidence on: 1) the effectiveness of web-based interventions aimed at decreasing alcohol consumption; and 2) participants' perceptions of the usefulness and potential benefits of the intervention. Additionally this paper aims to systematically assemble and evaluate the quality of the evidence available using established systematic review techniques. Systematic reviews are defined by key methodologies, including: (a) highly comprehensive searches in order to identify relevant studies; (b) explicit inclusion criteria and transparency concerning study eligibility and (c) rigorous quality appraisal. The use of a standardized quality rating tool (i.e., Downs and Black, 1998) was employed as part of this process.

## **Method**

### *Literature search and selection of studies*

Relevant articles published up to, and including, May 2006 were identified through electronic searches of Medline, PsycInfo, Embase, Cochrane Library, ASSIA, Web of Science and Science Direct. The following terms were used in the search: (a) intervention *and* web *and* alcohol; (b) intervention *and* electronic *and* alcohol; (c) internet *and* alcohol consumption; (d) internet *and* drinking behaviour; (e) internet *and* drinking behavior. Searches were not limited by language. The titles and abstracts of all potentially relevant articles were independently reviewed for possible inclusion by two of the authors (BMB, KT). Articles were included if: 1) the intervention of interest was delivered via the World Wide Web; 2) if a focus of the intervention was alcohol consumption; and 3) if the study included an evaluation of the intervention. Reference lists of all articles identified as relevant for inclusion were checked independently by two authors (BMB, KT). Inclusion/exclusion agreement between authors was measured using kappa ( $\kappa$ ) and disagreement was settled by consensus between the two authors.

### *Quality rating and hierarchy of evidence*

Using the full text, two authors (BMB, KT) independently quality rated the articles selected for inclusion. Primary studies were rated using the criteria set out by Downs and Black (1998). This scale is regarded as being reliable and easy to use and particularly suitable for the evaluation of non-randomized intervention studies in systematic reviews (Deeks et al., 2003). The quality rating tool comprises 27 items and provides an overall score for a study as well as a score for the quality of reporting and both the internal and external validity. Agreement between researchers was measured using kappa ( $\kappa$ ) and disagreement settled by consensus. At this stage articles which did not meet the original inclusion criteria were excluded.

All included studies were independently rated by three authors and one additional researcher (BMB, KT, JC, JS) according to an adapted hierarchy of evidence (adapted from Harris et al., 2001). Classification of evidence was as follows: I-1 evidence from randomized control trial(s); I-2 evidence from randomized comparison trial(s); II-1 evidence from controlled trial(s) without randomization; II-2 evidence from cohort or case-control studies; II-3 evidence from comparisons between times or places with or without the intervention; and III descriptive studies. For the purposes of the current review efficacy studies are presented with studies of effectiveness.

### *Data extraction*

Data extraction was carried out independently by two authors (BMB, KT). Outcome measures were selected based on comparability across studies and therefore only relevant results were extracted. The following pre- and post-intervention details, where appropriate, were extracted: sample size, description of population, age, gender, Alcohol Use Disorders Identification Test (AUDIT) scores, quantity of alcohol consumption per week, frequency of heavy drinking, maximum alcohol consumption per day, perceived usefulness of the intervention, percentage surprised by the information provided, functionality of the site and perceived change/benefit of the intervention. Where appropriate, pre- to post-change scores were also extracted. Where information was not readily available in the published article lead authors were contacted and asked to supply the necessary information.



### *Statistical analyses*

For effectiveness studies pre-, post- and mean difference data pertaining to AUDIT score, unit quantity consumed, maximum consumption and frequency of heavy drinking were extracted, where available, for both intervention and comparison groups. The mean difference scores for both intervention and comparison groups and the pre- and post- scores for the intervention group were entered into RevMan (2002) and effect size graphs were produced. Standardized mean difference and fixed effects model was used for calculations. Where information from authors resulted in a re-analysis of the original data, some numbers provided (e.g. sample size) deviate slightly from those originally published. Where data were not available, studies were excluded from the relevant analysis. Due to the heterogeneous nature of the studies (in terms of populations, research designs and measurement unit) it was not deemed appropriate to combine the data using meta-analysis.

### **Results**

From the initial search 191 articles were identified and 27 of these were found to be eligible for inclusion (20 primary studies and seven review studies). The kappa statistic for inter-rater agreement on the inclusion or exclusion of studies was 0.83 – indicating substantial agreement (Viera and Garrett, 2005). Of these, 10 primary studies and 7 review studies were excluded upon closer reading due to the content of the articles not meeting the inclusion criteria ( $k=1.0$ ). One dissertation was also excluded as the British Library was unable to supply a copy. Detailed reading of reference lists of all included articles by two independent researchers (BMB, KT) resulted in the inclusion of one additional primary study.

Of the 10 primary articles, five provided a process evaluation only with the remaining five studies providing some pre-post measure of effectiveness (see Figure 1). Characteristics of the included studies are provided in Table 1. The purpose of the studies varied across the ten identified for inclusion (see Table 1).

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Insert Figure 1, and Tables 1-2 about here  
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### *Hierarchy of research design*

One of the 10 studies was a randomized control trial, four were randomized trials incorporating a comparison group(s), one was a controlled study without randomization, one was a cohort study and three were descriptive studies (see Table 2). Of the five randomized trials details of how randomization took place was reported in all but one (Cunningham et al., 2005).

### *Analysis of effectiveness studies*

A summary of the headline results presented by each of the effectiveness articles identified is presented in Table 1. Pre- and post-data were available for three (Chiauzzi et al., 2005; Cunningham et al., 2005; Moore et al., 2005) of the five effectiveness studies identified (see Table 3).

Chiauzzi et al. (2005) compared an interactive web-site with personalized feedback to an education only website (see Table 1). The intervention program delivered tailored motivational feedback about high risk drinking. Participants (n=265) worked through four weekly 20-minute sessions. All participants were students who reported binge drinking once in the last week (i.e. 5+ drinks for men and 4+ drinks for women). No meaningful differences were found at baseline between the two groups with regard to unit quantity, frequency of heavy drinking and maximum consumption per day (see Table 3). No meaningful differences were found with regard to the ability of the interventions to reduce unit quantity, frequency of heavy drinking or maximum consumption per day (see Table 3 and Figure 2). Pre- to post-intervention the personalized feedback group did reduce unit quantity, frequency of heavy drinking and maximum consumption per day (see Table 3) and smaller but meaningful reductions were also observed in the education only group (see Table 3).

Moore et al. (2005) compared web-based prevention newsletters with print-based prevention newsletters (see Table 1). The intervention consisted of a series of four newsletters. The

appearance of materials was similar for both web- and print-based versions. Each newsletter included the following components: (1) question challenging an alcohol expectancy belief, (2) a statement refuting the belief, (3) definitions of standard drinks, (4) strategies for reducing the risk of binge-drinking and (5) useful internet links. There was a small effect size difference between the groups at baseline (i.e., pre-intervention) with the web-based group reporting lower average levels of unit quantity, maximum consumption and frequency of heavy drinking (see Table 3; note that the effect size confidence intervals all include zero). Their results suggest that the print-based newsletters were more effective in terms of reducing unit quantity, maximum consumption and frequency of heavy drinking. However the effect size confidence interval contains zero for both unit quantity and frequency of heavy drinking (see Table 3 and Figure 2). When considering the pre- to post-intervention change for the web-based group alone no meaningful effect was found (see Table 3).

Cunningham et al. (2005) compared a web-based intervention to a web-based plus self-help book intervention (see Table 1). The web-based intervention provided brief personalized information and feedback about participants' drinking. The additional self-help materials were sent via postal mail. Meaningful differences were found between the two groups at baseline with regard to both AUDIT and unit quantity measures with higher means for the intervention plus self-help group (see Table 3). However, the confidence intervals around the effect size both include zero and therefore this difference should be treated with caution. The web-based intervention combined with self-help was seen to be more effective at reducing both AUDIT and unit quantity scores (see Figure 2). The web-based intervention alone did result in a small reduction of AUDIT and unit quantity scores but in both instances the effect size confidence intervals include zero (see Table 3).

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Insert Table 3 & Figure 2 about here  
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Kypri et al. (2004) evaluated the efficacy of a web-based brief intervention to reduce hazardous drinking amongst students. The intervention group (n=51) received personalized feedback via an interactive website while the comparison group (n=53) received an alcohol fact and effect leaflet. Participants in the intervention group received a summary of their recent

consumption, their risk status along with a comparison with the recommended limits, an estimate of their blood alcohol concentration and normative feedback. The research staff involved in the study were blind to participants' group allocation. Mean and standard deviation statistics were unavailable for the frequency of heavy episodic drinking however the ratio of geometric means reported in the original paper suggest a better outcome for the brief intervention compared with control (0.63,  $p=0.02$ ) at six-week follow up. This difference was no longer significant at six-month follow up (0.85,  $p=0.38$ )

Kypri and McAnally (2005) examined the efficacy of a brief web-based intervention for multiple risk behaviors for university students. The computerized feedback and advice provided to intervention participants included (1) health authority recommendations and, (2) social norms and self-comparisons information. The intervention group ( $n=72$ ) was compared to two control groups; one completed a web-based questionnaire at baseline and at follow up ( $n=72$ ), the second completed assessment only at follow-up ( $n=74$ ). Of relevance to the current review's data extraction participants were asked to report the largest amount consumed in the previous four weeks and to complete AUDIT. Unfortunately the results pertaining to these outcome measures were not available at the time of writing this review. Kypri and McAnally (2005) reported no significant difference in the percentage of compliance with recommended levels of alcohol consumed per occasion between participants who received computerized assessment feedback and advice, participants who completed electronic assessment pre- and post, or participants who completed electronic assessment post- only. [Note: Of the Kypri and McAnally (2005) sample, 25% of participants were non-drinkers or light-drinkers].

In general, the mean difference effect size comparison across the three effectiveness studies for which data were available (Chiauzzi et al., 2005; Cunningham et al., 2005; Moore et al., 2005) suggests that, where a meaningful difference was found, the outcome favors the comparison group over web-based intervention conditions (see Figure 2). When considering the pre- to post- intervention scores alone the Chiauzzi et al. (2005) intervention, which included personalized feedback, produced more favorable outcomes compared with information only results (i.e. Moore et al., 2005). The pre- to post- results for the personalized feedback condition obtained by Cunningham et al. (2005) are less clear. Although the authors observed a pre to post improvement, results should be interpreted with caution as the confidence intervals are large and include zero.

### *Analysis of process data*

A summary of the headline results presented by each of the process articles identified is presented in Table 1. In general, the process feedback provided was positive in terms of the usefulness of the site: 57% of participants reported that the websites were interesting (Westrup et al., 2003), 61% accurate in feedback (Cunningham et al., 2000), 80% helpful (Linke et al., 2004) and 20%-56% useful (Bendsten et al., 2006; Cunningham et al., 2000). At least three quarters of participants also reported finding the sites easy to use (Bendsten et al., 2006; Westrup et al., 2003). In addition, a small but notable percentage (3%-8%) of participants reported that they felt that the information would change their alcohol habits for the better (Bendsten et al., 2006; Westrup et al., 2003).

Lieberman et al. (2003) found that the perceived helpfulness was lower for alcohol abusers in comparison to responses given by non-alcohol abusers, while Westrup et al. (2003) reported that high- and moderate-risk participants perceived a greater change in their alcohol use when compared to low-risk participants. Westrup et al. (2003) also reported that high-risk participants were more interested in the alcohol information provided compared to low-risk participants.

### *Quality ratings*

All 10 primary studies were rated on Downs and Black (1998) scale and the percentage of criteria met was calculated for each subscale and for the checklist overall ( $\kappa = 0.79$ ). These results are presented for both effectiveness and process studies (see Table 4).

Overall the average percentages of criteria met was greater for effectiveness studies than for process studies (see Table 4).

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Insert Table 4 about here  
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## Discussion

The Downs and Black (1998) ratings suggest that the strength of the evidence provided within the current review is weak with only one of the 10 included studies (Kypri and McAnally, 2005) meeting more than 75% of the criteria and only a further three (Chiauzzi et al., 2005; Moore et al., 2005; Kypri et al., 2004) meeting more than 50%. These relatively low scores reflect the lack of rigor within the research designs employed.

The one randomized control trial included in the review (i.e. Kypri and McAnally, 2005) did not report a significant effect of an electronic Screening and Brief Intervention (eSBI) on alcohol related outcome measures and the data from this trial were not made available for the current analysis. Initial work by Kypri et al. (2004) found a significant reduction in quantity consumed per typical occasion in the intervention group. However Kypri and McAnally (2005) found no significant difference between the control and intervention groups on their outcome measures. Kypri and McAnally (2005) suggested that the inability to support the Kypri et al. (2004) findings indicating that web-based interventions may be effective could be due to the relatively large number of non- or low-drinkers within the 2005 study. The Westrup et al. (2003) finding that high-risk participants perceived a greater change and were more interested in the material presented provides some support for the suggestion that eSBI's may be more effective for high risk participants than for low-risk participants. Liberman's (2003) study, however, suggests that perceived helpfulness could be lower for alcohol abusers. The seemingly contradictory results across studies highlight the need for further research to understand the relationship between levels of alcohol consumption and effectiveness of any intervention administered.

The current review provides inconsistent evidence on the effectiveness of eSBI. Within the current review the majority of effectiveness studies utilized a comparison group rather than a pure control and this has implications in terms of possible conclusions that can be drawn about the effectiveness of web-based interventions. Where web-based personalized feedback alone was compared to web-based feedback combined with additional self-help material the results favored the combined intervention (Cunningham et al, 2005). Where web-based newsletters with no personalized component were compared to traditional print newsletters the results

suggest that traditional print modes of delivery are more effective (Moore et al, 2005). However when a web-based text education website without personalized feedback was compared to a personalized interactive website the results did not favor either intervention (Chiauzzi et al., 2005).

Given the lack of pure controls in the majority of the effectiveness studies the current review also considered the pre- to post-intervention results within the intervention group alone. Those studies that utilized personalized feedback within their web-site intervention alone condition (i.e. Cunningham et al, 2005; Chiauzzi et al., 2005) provided more favorable results than the study that did not provide personalized feedback within the web-site intervention (i.e. Moore et al, 2005). This suggests that it may be the automated personalized feedback that is likely to impact on participants' behavior rather than the electronic delivery per se. That is, non-personalized educational material delivered electronically may be no more, perhaps even less, effective than more traditional modes of delivery (e.g. Moore et al., 2005). The current evidence does not provide detailed insight into what elements of personalized feedback are effective nor does it provide evidence on whether interventions are likely to be effective for both high and low risk drinkers. Again, further research is needed to address these issues.

The current review identified only five effectiveness studies and the results obtained across studies did not yield consistent findings. Furthermore the studies were characterized by the following limitations: 1) outcome measures used were heterogeneous, 2) relatively small sample size at follow-up, 3) large standard deviations with the data appearing to be skewed and log transformed scores were only available in one instance (i.e. Cunningham et al., 2005), 4) lack of controls within the majority of the studies identified, and 5) in some cases, there were large confidence intervals around the effect size. The lack of a control condition also makes it difficult to attribute with confidence any change to the intervention provided – it is possible that any recorded change could have occurred independently of the intervention. Where comparison groups were used, there were often differences between the conditions on baseline measurements. Indeed the potential pitfalls of interpreting pre- post- change within conditions as evidence of efficacy has been highlighted (Vickers and Altman, 2001) and there is agreement regarding a need for future designs to include a control condition and for results to be analyzed using change scores. Only then will the issue of eSBI efficacy be addressed.

Although recent publications suggest that there has been a sharp increase in the number of web-based interventions available (Copeland and Martin, 2004), this systematic review suggests that there is a relatively small number of published data on the effectiveness of such interventions, while the process studies suggest positive feedback from users. Given the potential ability for web-based interventions to reach a wide audience at low cost, it would appear prudent to ensure that the efficacy of such interventions is evaluated before making them available to the public via the world wide web.

### **Limitations**

The current review has a number of limitations, namely that outcome data were not available for all of the ten studies identified for inclusion. Furthermore the heterogeneous nature of the studies, in terms of the interventions evaluated and the study objectives, prohibited any meta-analysis to be carried out. It is therefore not possible or advisable to draw any firm inferences from these results.

### **Conclusions**

Earlier published non-systematic reviews have investigated the potential feasibility and content of web-based interventions designed to moderate alcohol use. The current review is the first to systematically evaluate the effectiveness of such interventions and has found inconsistent results across studies. Process research suggests that web-based interventions are generally well received. However further randomized control trials are needed to investigate their effectiveness. All of the identified effectiveness studies focused on web-based interventions targeted at the North American or New Zealand student population. Further research is therefore required to demonstrate the generalizability of these interventions to other populations and settings. There is a need for future studies to determine which elements of personalized feedback are key to outcome and whether different elements are needed to engage low and high risk drinkers. Future research should ensure that sample sizes are adequate and powered to detect relatively modest effects. Given the current heterogeneous nature of outcome measures used within eSBI for alcohol consumption, there is also a need for research validating self-report web-based outcome measures.



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Table 1: Sample characteristics, purpose and findings of effectiveness and process studies designed to evaluate web-based interventions for alcohol use

Author (year)	Sample size <sup>a</sup> n	Population	Age M <sup>b</sup> (SD) <sup>c</sup>	Female %	Purpose	Findings <sup>d</sup>
<i>Effectiveness studies</i>						
Chiauzzi et al. (2005)	265	Binge drinkers from U.S. college	19.9 (1.6)	54	To evaluate the efficacy of an internet-based brief intervention program that delivers tailored motivational feedback about high-risk drinking.	Women who used the intervention site reported reducing their peak and total consumption during special occasions and also fewer negative consequences. Heavy binge drinkers who used the intervention site reported a more rapid decrease in average consumption and peak consumption when compared to the comparison group.
Cunningham et al. (2005)	86	Visitors to website (predominantly Canadian/USA residents)	37.9 (13.0)	69	To evaluate the effectiveness of a personalized feedback website plus self-help book for problem drinkers compared to receiving the personalized feedback website alone.	Those receiving additional self-help material reported drinking less and experiencing fewer consequences at follow-up.

Kypri and McAnally (2005)	218	New Zealand students attending student health service	20.2 (1.5)	49	To examine the efficacy of a brief web-based intervention for multiple risk behaviors for university students.	No significant difference found between intervention control and comparison groups with regard to compliance with recommended episodic consumption limits.
Kypri et al. (2004)	112	New Zealand binge drinker students attending student health service		50	To evaluate the efficacy of a web-based brief intervention to reduce hazardous drinking.	At 6 weeks the intervention group reported significantly lower levels of total consumption, lower frequency of very heavy episodic drinking and reduced consequences of heavy drinking when compared to controls. Both interventions were feasible. Results did not differ by delivery mode.
Moore et al. (2005)	133	Students from 3 courses at 1 U.S. university.	21.7 (0.2)	58	Feasibility and efficacy of a binge drinking web-based newsletter versus a print-based intervention for college students.	Significant decrease in 30-day frequency of drinking over time. Significant binge by time interaction with binge drinkers (n=44) decreasing 30-day average quantity and greatest number of drinks. Number of non-binge drinkers (n=56) increased.

*Process Studies*

Bendsten et al. (2006)	3875	University students in Sweden		44	To evaluate the feasibility of an electronic screening and brief intervention for college students.	Significant correlation between students' drinking pattern and perceptions of whether personalized advice would lead to change. Students drinking at risky levels were more likely to state that they would change their behavior.
Cunningham et al. (2000)	243	Visitors to website (predominantly Canadian/USA residents)	33.8 (12.6)	56	To detail and evaluate the development of a brief assessment and normative feedback internet programme.	Approximately 50% of participants reported finding the feedback useful.
Lieberman (2003)	1432	Visitors to website	35.0 (11.4)	57	To investigate subject interactions and level of satisfaction with an online alcohol use feedback website.	Alcohol abusers reported finding the site more helpful than non-abusers.



Linke et al. (2004)	1319	Visitors to website (predominantly white British)	38.1 (9.6)	44	To evaluate the usefulness of a web-based intervention designed to promote healthy drinking behavior	Over 80% of users stated that they found the programme 'helpful' or 'very helpful'.
Westrup et al. (2003)	857	Employees from highly educated workforce in California	40.9 (11.0)	77	To investigate employee's reactions to web-based assessment and intervention for alcohol use.	Approximately 81% of participants reported that the website was easy to use and the majority stated that the information provided was interesting.

<sup>a</sup> n displayed is the number of consenters

<sup>b</sup> Mean

<sup>c</sup> Standard Deviation

<sup>d</sup> Not all findings are included in review analysis

Table 2: Hierarchy of evidence ratings with intervention and control details for effectiveness and process primary studies designed to evaluate web-based interventions for alcohol use

Author (year)	Level of evidence	Intervention	Control or comparison group
<b>Effectiveness studies</b>			
<i>Studies incorporating a pure control</i>			
Kypri and McAnally (2005)	I-1	Computerized assessment feedback and advice (n=72) <sup>g, f</sup> .	Pure control: Web-based questionnaire at baseline and follow-up (n=72).  Other control group: Computerized assessment at follow-up only (n=74).
<i>Studies incorporating comparison group</i>			
Chiauzzi et al. (2005)	I-2	Interactive website with personalized feedback. Four weekly 20 minute sessions (n=131) <sup>c, f, i</sup> .	Text based education only website. Four weekly 20 minute sessions (n=134) <sup>c</sup> .
Kypri et al. (2004)	I-2	Interactive website providing personalized feedback (n=51) <sup>e, f, g, h, i</sup> .	Alcohol fact and effects leaflet (n=53) <sup>c</sup> .
Moore et al. (2005)	I-2	Web-based prevention newsletters sent once a week for four weeks via email link (n=59) <sup>a, b, c, d</sup> .	Print-based prevention newsletters sent once a week for four weeks via post (n=57) <sup>a, b, c, d</sup> .
Cunningham et al. (2005)	I-2	Internet personalized feedback <sup>e, f</sup> only (n=29).	Interactive website with personalized feedback <sup>e, f</sup> and self-help book (n=19).
<b>Process studies</b>			
Westrup et al. (2003)*	II-1	Interactive website with full personalized feedback <sup>i</sup> .	Interactive website with limited personalized feedback.
Linke et al. (2004)	II-2	6-week web-based structured programme.	
Bendsten et al. (2006)	III	Interactive website with personalized feedback <sup>e, f, i</sup> (n=742).	
Cunningham et al. (2000)	III	Interactive website with personalized feedback (n=214) <sup>c, e, f, h, i</sup> .	

Lieberman (2003) III Interactive website with personalized feedback<sup>e, i</sup> (n=1455).

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\* A total of 187 participants completed all phases of the study; sample breakdown by treatment group was not available.  
*Non-personalized feedback:* <sup>a</sup> alcohol-expectancy belief; <sup>b</sup> risks associated with alcohol consumption; <sup>c</sup> general information (e.g. definitions of standard drinks); <sup>d</sup> strategies for reducing risks associated with alcohol consumption.  
*Personalized feedback:* <sup>e</sup> summary of drinking behavior/profile; <sup>f</sup> normative feedback; <sup>g</sup> comparisons with guidelines; <sup>h</sup> estimate of blood alcohol and/or time needed to metabolize reported alcohol consumption; <sup>i</sup> risk feedback

Table 3: Pre- and post- AUDIT, unit quantity, frequency of heavy drinking and maximum consumption per day data for effectiveness studies designed to evaluate web-based interventions for alcohol use

Outcome measure/Author (year)	n	Pre		Post		Mean Difference		ES <sup>a</sup> <i>d</i>	
		M <sup>b</sup>	SD <sup>c</sup>	M <sup>b</sup>	SD <sup>c</sup>	M <sup>b</sup>	SD <sup>c</sup>		
<i>AUDIT<sup>d</sup></i>									
Kypri et al. (2004) <sup>1</sup>	Intervention		16.6	5.7					
	Control		16.6	6.0					
Cunningham et al. (2005)	Intervention	29	15.6	8.9	12.6	7.8	-3.0	6.6	0.36 <sup>e</sup>
	Comparison	19	19.8	10.3	11.9	9.9	-7.6	8.6	0.78
	Between group ES <i>d</i>		-0.44 <sup>e</sup>		0.08 <sup>e</sup>		0.62		
<i>Unit quantity</i>									
Chiauzzi et al. (2005) <sup>2</sup>	Intervention	131	19.6	15.9	14.6	13.2	-5.0	28.6	0.34
	Comparison	134	23.3	15.6	17.5	13.0	-5.8	28.1	0.40
	Between group ES <i>d</i>		-0.23 <sup>e</sup>		-0.22 <sup>e</sup>		0.03 <sup>e</sup>		
Cunningham et al. (2005) <sup>2</sup>	Intervention	29	21.0	16.6	17.40	17.70	-2.80	13.4	0.21 <sup>e</sup>
	Comparison	19	29.1	23.2	18.40	25.80	-10.70	16.0	0.44 <sup>e</sup>
	Between group ES <i>d</i>		-0.42 <sup>e</sup>		-0.05 <sup>e</sup>		0.55 <sup>e</sup>		
Moore et al. (2005) <sup>3</sup>	Intervention	53 <sup>f</sup>	2.5	2.42	2.53	2.4	0.40 <sup>f</sup>	1.80	-0.01 <sup>e</sup>
	Comparison	47	3.2	2.73	2.51	2.3	-0.60 <sup>f</sup>	1.50	0.27 <sup>e</sup>
	Between group ES <i>d</i>		-0.27 <sup>e</sup>		0.01 <sup>e</sup>		-0.12 <sup>e</sup>		
<i>Frequency of heavy drinking</i>									
Chiauzzi et al. (2005) <sup>4</sup>	Intervention	131	2.3	1.30	1.60	1.40	-0.70	2.70	0.52
	Comparison	134	2.4	1.30	1.50	1.40	-0.60	2.60	0.67
	Between group ES <i>d</i>		-0.08 <sup>e</sup>		0.07 <sup>e</sup>		0.04 <sup>e</sup>		

Moore et al. (2005) <sup>5</sup>	Intervention	53	0.80	1.10	0.80	1.40	0.10 <sup>f</sup>	0.90	0.00 <sup>e</sup>
	Comparison	47	1.10	2.00	1.30	2.60	0.40 <sup>f</sup>	1.20	0.09 <sup>e</sup>
			-0.19 <sup>e</sup>		-0.24 <sup>e</sup>		-0.29 <sup>e</sup>		
<i>Maximum consumption per day</i>									
Chiauzzi et al. (2005) <sup>6</sup>	Intervention	131	2.00	0.5	1.60	0.70	-0.40	1.12	0.66
	Comparison	134	2.00	0.5	1.70	0.70	-0.30	1.11	0.49
	Between group ES <i>d</i>		0.00 <sup>f</sup>		-0.14 <sup>f</sup>		-0.09 <sup>f</sup>		
Moore et al. (2005) <sup>7</sup>	Intervention	53	4.40	5.2	4.30	5.00	-.10 <sup>g</sup>	2.30	0.02 <sup>f</sup>
	Comparison	47	5.30	5.4	4.60	5.40	-.60 <sup>g</sup>	2.80	0.13 <sup>f</sup>
	Between group ES <i>d</i>		-0.17 <sup>f</sup>		-0.06 <sup>f</sup>		0.20 <sup>f</sup>		

\* AUDIT and largest amount consumed in last 4 weeks data was collected but not available for Kypri and McAnally (2005); Pre data on total number of drinks in the proceeding 2 weeks and pre post data frequency in last 2 weeks was collected but was unavailable for Kypri et al. (2004).

<sup>1</sup>Post data for Kypri et al. (2004) was not available; <sup>2</sup>Quantity per average week; <sup>3</sup>Quantity last 30 days; <sup>4</sup> Binge drinking days per week; <sup>5</sup> Two week frequency of binge drinking; <sup>6</sup> Past week greatest number of drinks at one time log transformed scores; <sup>7</sup> 30 Day greatest number of drinks at one time

<sup>a</sup> Effect Size, <sup>b</sup> Mean, <sup>c</sup> Standard Deviation

<sup>d</sup> Alcohol Use Disorders Identification Test

<sup>e</sup> Confidence interval includes zero

<sup>f</sup> For mean difference intervention n=55, control n=50

Table 4: Percentage of Downs and Black (1998) criteria met for effectiveness and process studies designed to evaluate web-based interventions for alcohol use

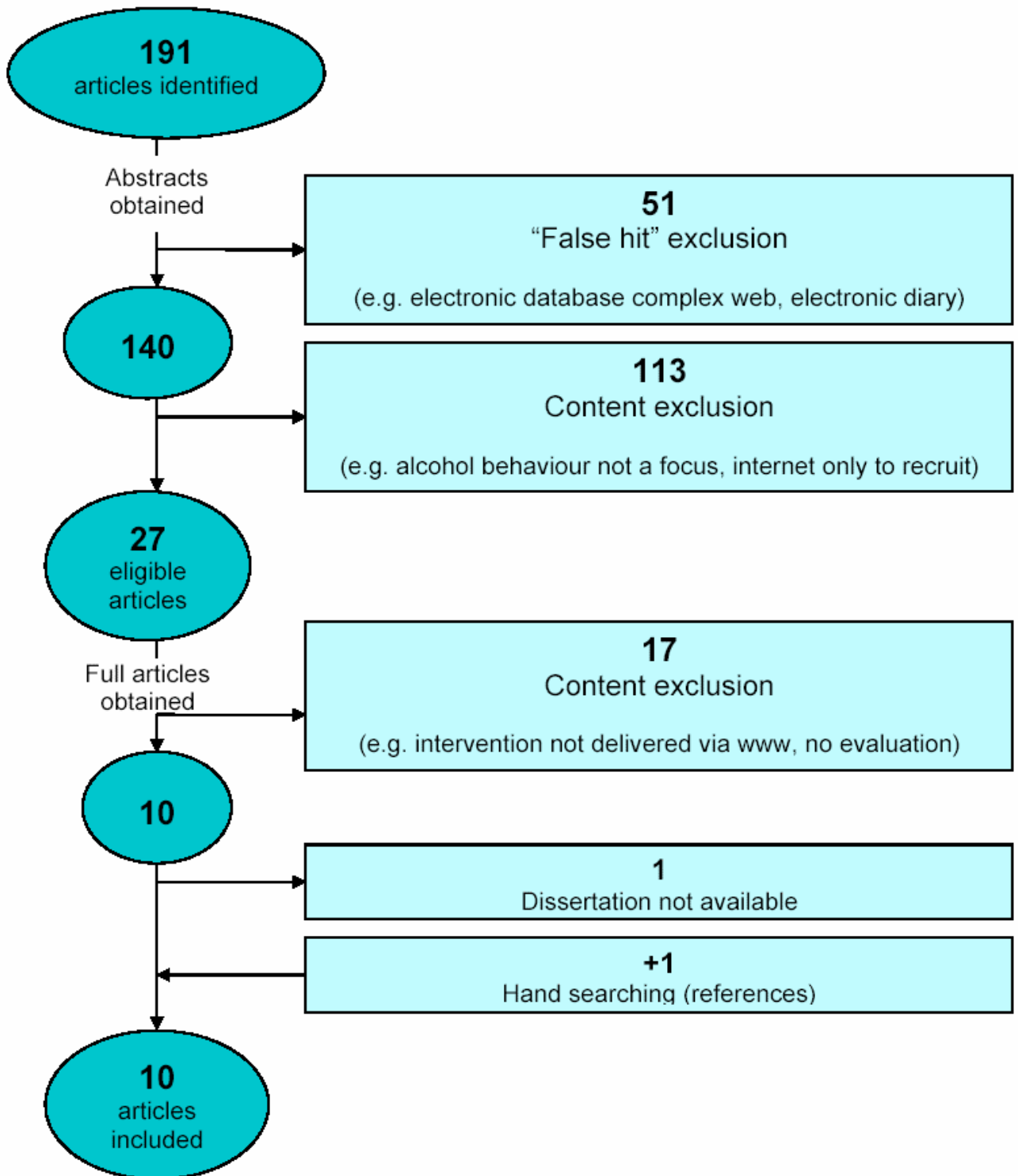
	Reporting %	External validity %	Internal validity – bias %	Internal validity - confounding (selection bias) %	Overall %
<i>Effectiveness studies</i>					
Kypri and McAnally (2005)	70	67	100	86	81
Chiauzzi et al. (2005)	80	33	86	71	74
Kypri et al. (2004)	60	33	100	71	70
Moore et al. (2005)	70	33	71	71	67
Cunningham et al. (2005)	60	33	57	0	41
<b>Mean of effectiveness studies</b>	<b>68</b>	<b>40</b>	<b>83</b>	<b>60</b>	<b>67</b>
<i>Process studies</i>					
Bendsten et al. (2006)	70	33	71	0	48
Linke et al. (2004)	70	33	43	14	44
Westrup et al. (2003)	50	33	57	0	41
Lieberman (2003)	70	33	43	0	41
Cunningham et al. (2003)	50	33	57	0	37
<b>Mean of process studies</b>	<b>62</b>	<b>33</b>	<b>54</b>	<b>3</b>	<b>42</b>

**Figure Legend:**

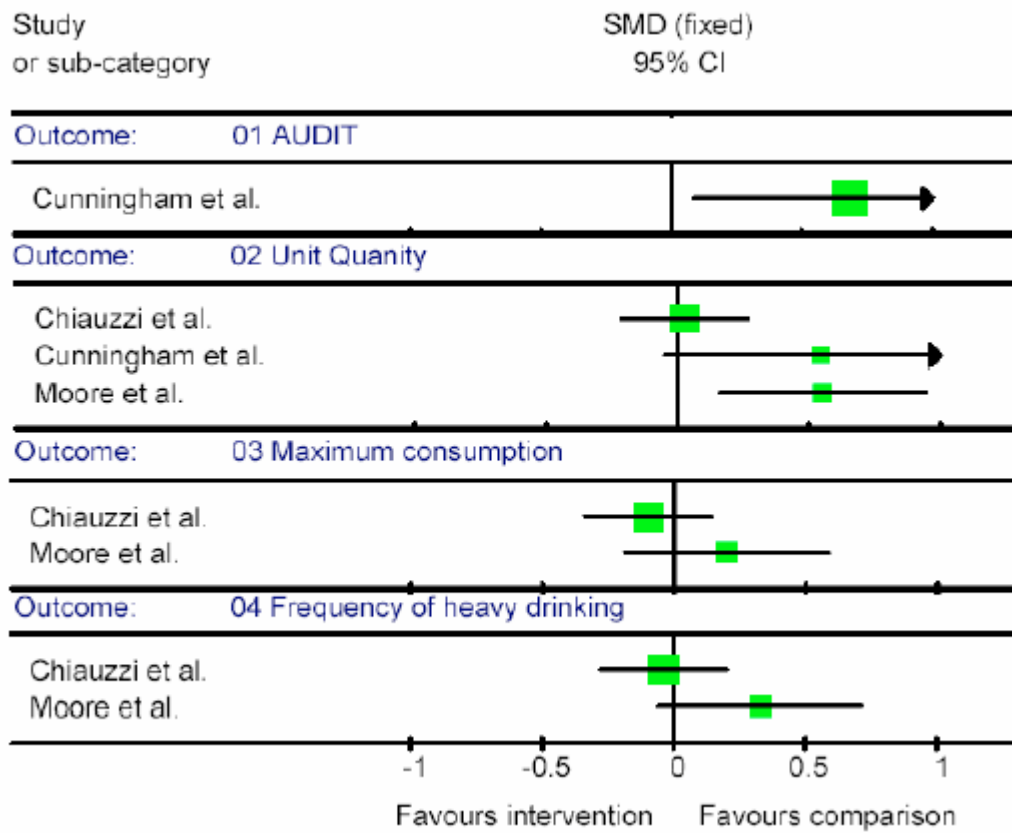
1: Flow diagram of the process of selecting studies designed to evaluate web-based interventions for alcohol use.

2: Effect size of mean difference between intervention and comparison group reported by studies designed to evaluate web-based interventions for alcohol use.

Figure 1







SMD= Standard Mean Difference; CI=Confidence Interval; AUDIT = Alcohol Use Disorders Identification Test;

④ Shows ES while line shows 95% confidence interval

**Précis**

The results presented within this systematic review are inconsistent and therefore no strong conclusions can be reached regarding the potential impact of web based interventions for alcohol consumption. More controlled research is needed to confirm the efficacy and effectiveness of brief web-interventions.