

language articles published up to and including April 2013. Key search terms used in the search were: (“Online Systems” OR “Internet” OR “Web” OR “Computer”) AND [“Alcohol”] AND [“Intervention” OR “Randomized Controlled Trial (RCT)”]. Reference lists of previously published reviews, meta-analyses and the included studies within this topic were also checked. Only publications focused on reducing alcohol use through WBIs were included.

Selection of studies

The effectiveness of an intervention summates multitude of issues. These include rigorousness of research design, level of control over confounding factors, quality of program implementation and intervention fidelity.^[5] Therefore, we included studies utilizing solely WBIs that were fully automated and excluded those that required additional elements, such as having face-to-face components or being delivered through intranet or mobile phone.

Abstracts of all potentially relevant articles were reviewed for possible inclusion. We included articles reporting RCT of an internet based alcohol-related intervention with at least one no-treatment control focused on curtailing alcohol use. Trials using internet only for recruitment or to remind participants of appointments for treatment but not for delivering the

intervention were excluded. Articles describing study protocols and dissertations were also excluded from the analysis.

Data extraction and analysis

Both authors independently carried out data extraction. Where data was insufficient or not available in the published paper or after contacting corresponding authors, studies were excluded from the analysis.

Results

We identified 63 potentially relevant articles evaluating WBI with/without co-interventions for reducing alcohol use [Figure 1]. Out of these 41 articles comprising 35 studies were included after fulfilling the eligibility criteria's.^[6-46] Among the excluded articles, eleven were study protocols, two had no control condition,^[47,48] two studies (one article) had,^[49] two studies evaluated only internet knowledge and usage,^[50,51] two studies assessed only attrition rates,^[52,53] one study focused on parent based intervention,^[54] one study focused intervention on treatment providers^[55] and one article was only an extension of previous study with an online survey only.^[56]

The characteristics of the included studies and participants, results of quality assessment and key findings are described below [Table 1].

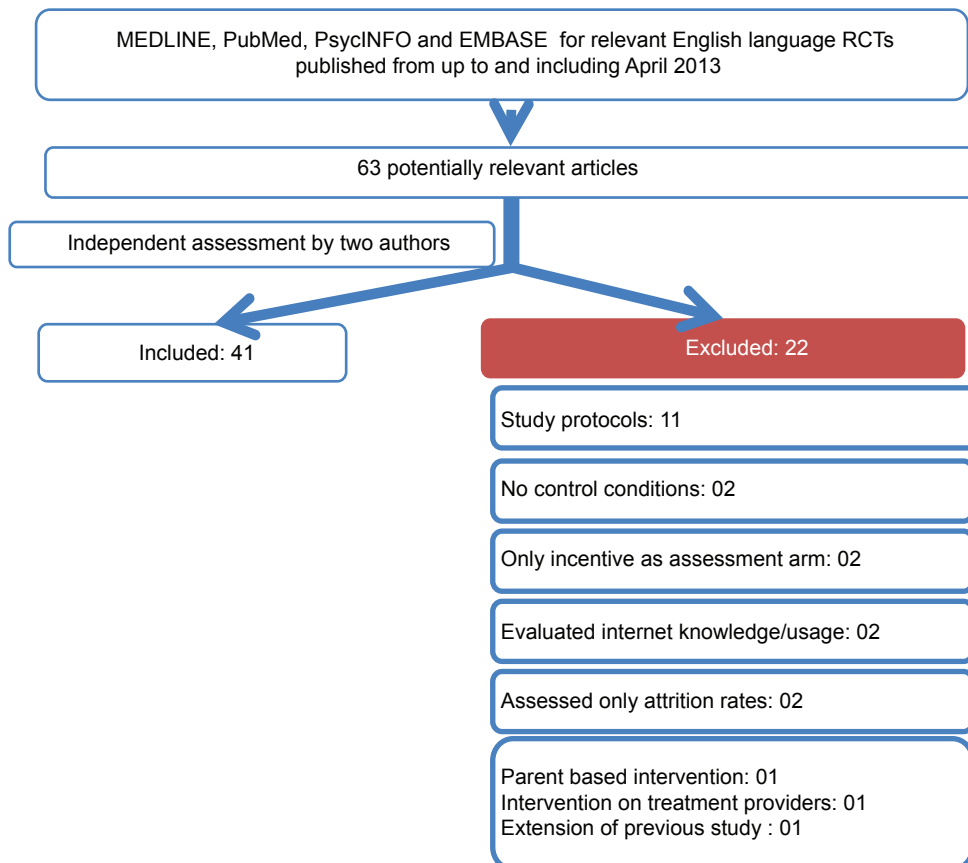


Figure 1: Algorithm for search and identification of studies

Table 1: Characteristics of studies included in the review

Study	Recruitment method	Participant characteristic (total study sample size)	Intervention and comparison (sample size)
Bendtsen <i>et al.</i> 2012 ^[43] Ekman <i>et al.</i> 2011 ^[44]	Mail-based invitation sent from student health services	University students (4227)	Routine practice assessment and feedback (1742) versus assessment-only without feedback (1742) versus no intervention (1743)
Cunningham 2012 ^[45]	Newspaper advertisements in a metropolitan city	General population sample of problem drinkers (170)	Extended Internet intervention (AHC) (83) versus brief Internet intervention (CYD) (87)
Hansen <i>et al.</i> 2012 ^[46]	Letter invitation to the Danish health examination survey participants	General population-based sample of heavy drinkers (1380)	Fully automated Internet-based brief personalized feedback intervention (476) versus fully automated internet-based personalized brief advice intervention (450) versus no intervention (454)
Farrer <i>et al.</i> 2012 ^[41]	Telephone callers to lifeline, a national telephone counseling service	General population with moderate to high psychological distress (155)	Web CBT plus weekly telephone tracking versus web CBT only versus weekly telephone tracking only versus no intervention
Evers <i>et al.</i> 2012 ^[42]	From school	Middle school students (1590)	Internet-based, tailored intervention versus no intervention
Paschall <i>et al.</i> 2011 ^[37]	Online through student health services	University freshmen students (5074)	Online course (alcohol education) (2412) versus no intervention (2662)
Boon <i>et al.</i> 2011 ^[35]	Online questionnaires	Male adults with heavy alcohol use (>20 units of alcohol weekly) and/or binge drinking (>5 units of alcohol at a single occasion at least 1 day/week) in the past 6 months (450)	Online personalized feedback (230) versus information-only control (220)
Delrahim-Howlett <i>et al.</i> 2011 ^[36]	Personalized recruitment of users of WIC services	Moderate drinking, low-income, non-pregnant reproductive age females (131)	Personalized feedback intervention (68) versus general health information (63)
Wallace <i>et al.</i> 2011 ^[40]	Users recruited from DYD website	Individuals with hazardous alcohol consumption (7935)	Psychologically enhanced website (DYD) (3981) versus typical alcohol website (3954)
Palfai <i>et al.</i> 2011 ^[39]	Recruitment for course credit	psychology students who either had two episodes of heavy episodic drinking in the past month or scored ≥ 8 on the AUDIT (119)	Alcohol feedback with or without motivational assessment versus no intervention control with or without motivational assessment
Collins <i>et al.</i> 2011 ^[38]	Recruited through advertising (radio, TV, newspapers, university website) using the university media unit and via workplace-based E-mails and notices, screening was done over telephone	Men participating in an obesity intervention as part SHED-IT study (65)	Internet (SHED-IT) (34) versus information-only (31)
Spijkerman <i>et al.</i> 2010 ^[34]	Volunteer members of an online access panel recruited through survey	15-20 year-old binge drinkers (575)	WBI without normative feedback versus WBI with normative feedback versus no intervention
Postel <i>et al.</i> 2010 ^[32]	Recruited through an advertisement on website, television and E-mail to website users	Problem drinkers in the general population (156)	E-therapy program (78) versus wait list control (78)
Fang 2010 ^[29]	Recruited through online advertisements and from community service agencies; \$20 and \$25 incentive	Asian-American girls aged 10-14 years and their mothers (108)	Web-based substance use prevention program versus no intervention
Hendershot <i>et al.</i> 2010 ^[30]	Recruited via phone and e-mail	Asian-American young adults (200)	Web-based personalized genetic feedback versus attention-control feedback
Cunningham <i>et al.</i> 2009, 2010 ^[22,23]	Telephone survey	General adult population (≥ 18 years) with problem drinking (185)	Internet-based CYD screener and feedback (92) versus no intervention (93)

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Study	Recruitment method	Participant characteristic (total study sample size)	Intervention and comparison (sample size)
Newton <i>et al.</i> 2009, 2010 ^[27,28]	Student health services	Secondary school students (764)	Internet-based prevention program (397) versus usual health classes (367)
Hustad <i>et al.</i> 2010 ^[31]	Through letter and e-mail	First-year college students (82)	Alcohol education (26) versus alcohol e-Chug (31) versus assessment-only (25)
Schwinn <i>et al.</i> 2010 ^[33]	Users of the youth-oriented website, Kiwibox.com were recruited through e-mail	Adolescent school going girls (236)	Internet-based gender-specific drug prevention program versus no intervention
Kypri <i>et al.</i> 2009 ^[25]	Students attending university health care	Undergraduate university students (2050)	Web-based motivational assessment and personalized feedback (1251) versus only screening (1184)
Neighbors <i>et al.</i> 2009 ^[26]	Through letter and e-mail	College students turning 21 years of age (295)	Web-based personalized feedback (150) versus assessment only (145)
Croom <i>et al.</i> 2009 ^[21]	From college	First-year college students (3216)	Web-based alcohol education program (1608) versus assessment only (1608)
Doumas <i>et al.</i> 2009 ^[14] Hester <i>et al.</i> 2009 ^[24]	Students mandated for counseling Newspaper advertisement	College students General population heavy drinkers (84)	WPNF (46) versus WE (31) Web based training in a moderate drinking protocol and use of the online resources of MM (40) versus only online MM resource (44)
Riper <i>et al.</i> 2008 ^[19,20]	Newspaper advertisements and health-related websites	adult problem drinkers from general population (261)	Web based DL self-help intervention (130) versus online psychoeducational brochure on alcohol use (131)
Bewick <i>et al.</i> 2008 ^[18]	recruited through a student experience survey	University students (506)	Web based personalized feedback and social norms information (234) versus no intervention (272)
Kypri <i>et al.</i> 2008, 2005, 2004 ^[15-18]	Face-to-face interview of students attending a university health care service	University students with hazardous or harmful drinking (429)	Single dose e-SBI (138) versus multidoes e-SBI (145) versus text information only (146)
Doumas and Hannah 2008 ^[13]	Recruited at workplace	Young adults at workplace (124)	Web-based feedback (60) versus web-based feedback plus MI (63) versus no intervention (73)
Bersamin <i>et al.</i> 2007 ^[10]	Recruitment via on-campus orientation sessions and through a letter and e-mail	College freshmen	Online alcohol-misuse prevention course (College Alc) (320) versus no intervention (312)
Matano <i>et al.</i> 2007 ^[12]	Workplace website	Employees of a work site (145)	Full individualized stress and coping feedback only (not specified) versus full individualized stress and coping feedback with individualized feedback about alcohol-related problems (not specified)
Walters <i>et al.</i> 2007 ^[11]	Student health services	College freshmen (106)	e-CHUG feedback (not specified) versus assessment only (not specified)
Saitz <i>et al.</i> 2007 ^[9]	Recruitment through e-mail, \$100 Amazon.com gift certificates or ApplePod at drawing chance	College freshmen engaging in hazardous alcohol use	Extensive BI (324) versus minimal BI (326)
Weitzel <i>et al.</i> 2007 ^[8]	Recruited through e-mails and campus advertising	College students	Individually tailored messages on handheld computers (20) versus assessment only (20)
Chiauzzi <i>et al.</i> 2005 ^[7]	Through college newspaper ads, flyers, recruitment tables placed in high traffic areas on campus and during key events; \$135 incentive	College students (binge drinkers)	Interactive web site (MSB: Alcohol) (131) versus alcohol education web site only for information (134)
Moore <i>et al.</i> 2005 ^[6]	Convenience sample	College students (116)	WBI for binge drinking (59) versus print-based intervention delivered via postal mail (57)

AHC: Alcohol help center, BI: Brief intervention, CBT: Cognitive behavior therapy, CYD: Check your drinking, DL: Drinking less, e-Chug: Electronic-check up to go, e-SBI: Electronic-screening and brief intervention, MI: Motivational interviewing, MM: Moderation management, MSB: MyStudentBody.com, SHED-IT: Self-help, exercise and diet using information technology, WIC: Women infant and children, WBI: Web based interventions, WE: Web-based education, WPNF: Web-based personalized normative feedback, DYD: Down your drink, AUDIT: Alcohol use disorder identification test

Characteristics of Included Studies

Country of origin

Twenty studies were from USA.^[6-14,21,24,26,30,31,33,36,37,39,42] Eight studies were from Australia,^[15-17,25,27,28,38,41] five from Netherlands,^[19,20,32,34,35] three from Canada,^[22,23,29,45] two each from Sweden^[43,44] and UK^[18,40] and one study was from Denmark.^[46]

Study subjects

Overall the studies reported data from more than 50,000 participants with sample sizes ranging from a minimum of 65^[38] to a maximum of 5074.^[37] Two studies, however, did not specify the number of participants.^[11,12]

Fourteen studies recruited adults^[12,13,19,20,22-24,30,32,35,36,38,40,41,45,46] and 21 studies recruited school going or college students or adolescents.^[6-11,14-18,21,25-29,31,33,34,37,39,42-44] Three studies evaluated only female population.^[29,33,36]

Recruitment of study subjects

The subjects were recruited mainly from web with the participants using a particular website finding the WBI through online invitations.^[33-35,40] Other recruitment strategies included recruitment through non-internet based advertising (such as television commercials, radio and newspaper announcements, or flyers displayed in the schools at each respective site),^[7,24,45] a combination of internet based advertising and referrals from community service agencies,^[29] a combination of web based and non-web based advertisements^[32,38] and from attendees of Women Infant and Children services.^[36] Two studies recruited subjects from workplace.^[12,13]

Some studies recruited participants exclusively via single modality such as letter^[46], E-mail^[9] or telephonically.^[22,23,41] Others utilized E-mail in combination with letters^[10,26,31] or telephone.^[30] Student health services were utilized for recruitment through face-to-face enrolment,^[15-17,27,28] via E-mail,^[43,44] or online.^[37]

Use of incentives

Only three studies reported use of incentives to facilitate participation.^[7,9,29] One study offered course credits to the students.^[39]

Participant Characteristics

The characteristics of participants also varied across the studies. Majority of the studies involved adolescent or student populations.

WBI studies involving adults included problem drinkers,^[20,23,32,45] heavy or binge drinkers,^[24,35,46] moderate drinkers^[36] and those with hazardous alcohol consumption.^[40] Different definitions of drinking were used. Some adult studies involved WBI for

alcohol as an auxiliary intervention to another primary focal issue like psychological distress or obesity.^[38,41]

Majority of studies among students did not categorically identify alcohol used pattern. In fact, majority of the studies use being 1st year or freshmen as an inclusion criteria. Other studies included participants with binge drinking^[7,34] or hazardous or harmful drinking.^[15]

Three studies evaluated only female population, one including only adults and the other two female school going students.^[29,33,36] Two studies among adults recruited male subjects exclusively.^[35,38]

Nature of Interventions

The intensity and rigorousness of WBIs studied across these studies varied from low intensity interventions such as generalized online psycho-educational brochure^[20] to extensively tailored cumulative variants of an internet based intervention.^[40]

Majority used only web based personalized assessment and feedback as intervention.^[11,13,14,25,26,30,35,36,39,43,46] Few used structured modules as cognitive behavior therapy^[41] or brief intervention.^[9] Few studies among college students utilized an online course.^[10,39]

Majority of control groups received only an assessment, whereas others utilized a psycho-educational resource or face-to-face approach. In some interventions, screening or follow-up was done over telephone.^[38,41]

While majority of the interventions used a fixed intervention module, some used an individually tailored approach.^[8,29,32,42]

Some studies intervened at multiple times and made comparisons with a single time approach.^[15-17] While some compared an extended intervention to a brief one.^[45] Others compared advise to feedback.^[46] Only one study compared WBI to a print based intervention.^[6]

None of the studies used any pharmacological agent along with the WBI.

Outcomes Studied

Varied outcome measures have been employed across the studies. Studies utilized some quantitative measure of alcohol consumption such as frequency of drinking, blood alcohol concentration, or amount of alcohol consumed in terms of standard drinks or unit grams of alcohol. Only a few compared binge pattern drinkers with non-binge drinking population or non-drinkers to problem drinkers. A designated assessment period was included which varied among the studies from a typical week, the previous week, 2 or 6 weeks,

or up to last 12 months. Few studies assessed either a typical drinking occasion or binge drinking which may be event specific (like use on 21st birthday or pub nights)^[7,26] or event non-specific.^[37] Many studies also assessed secondary parameters such as problems or consequences related to alcohol use,^[8,17,28,31] help seeking intention,^[9] self-efficacy,^[8] alcohol-related knowledge,^[28] or readiness to change.^[7,9,24]

Studies comparing WBI to non-WBIs or no interventions at all

Around 71% (10/14) studies involving adult subjects compared a WBI with a non-WBI or no intervention^[12,13,22,23,30,32,35,36,38,41,46] as opposed to around 86% (19/22) studies involving children and adolescents.^[6,8,10,11,15,18,21,25-29,31,33,34,37,39,42,43]

WBI was found to be more effective in reducing alcohol consumption as compared to non-WBI or no intervention control population in only three studies involving adults.^[13,30,32] All these studies were with short-term follow-up. No difference was observed between the different study interventions in four studies.^[36,38,41,46] Two studies reported initially significant difference in favor of WBIs which was not sustained on long-term follow-up.^[22,23,35] One of the studies was underpowered to comment on the significance of difference.^[12]

Of studies involving school or college going children and adolescents, reduced alcohol consumption was observed on many assessment parameters (but not all) in majority of the studies. The significant difference was observed at follow-up interval of 1 month,^[25,31,34,39] 3 months^[10,18,34] and 12 months.^[15,28,29] No intervention benefit was observed in three studies.^[6,21,43] In four studies the initial benefit observed with WBIs when compared to controls at immediate post-intervention or 2-3 month post-intervention assessment was lost at later follow-up.^[8,11,37,42]

Studies comparing different WBIs

Around 43% (6/14) studies involving adult subjects compared one WBI to another,^[13,19,20,24,40,45,46] while only 31.8% (7/22) studies involving children and adolescents reported such comparison.^[7,9,14,15,31,34,39]

Among the adult studies, only one study with short-term follow-up (3 month) found a significant difference among different WBIs.^[24] Similarly only of the long-term studies found any significant difference among the interventions.^[19] Even in this study, the difference at 6 months was lost on long-term follow-up at 12 months.^[20] Only one study among college students reported a difference in WBIs with a web-based personalized normative feedback (WPNF) being better than a web-based education (WE) approach.^[14] However, this study was with a short-term follow-up of only 1 month.

Conclusions

A steady increase in WBIs for alcohol use makes it necessary to study these interventions systematically. With an increase in penetration of internet these interventions are likely to be offered to a larger number of problem alcohol users. The current article has reviewed the available evidence for these WBIs for alcohol use.

Systematic analysis of WBIs for alcohol use is a rather recent phenomenon. The first RCT involving a WBI for alcohol use was carried out in the year 2005. A total of 41 studies were included in the current review. Majority of the studies are from USA followed by Australia. There are no studies from Asia and Africa. A growing proportion of individuals in Asian and African countries have access to internet these days. Furthermore limited resources and cost-effectiveness of WBIs for alcohol couples with the growing burden of alcohol use problems in these countries makes a case for development and assessment of such WBIs for these countries as well.

The studies have been conducted among children, adolescents and adults. Some studies have focused exclusively on women. Overall a large number of subjects have been recruited in these studies. However, there is a significant inter-study difference for the sample size. Various approaches have been utilized to recruit study subjects. These include internet, non-internet based advertising (such as television commercials, radio and newspaper announcements, or flyers displayed in the schools at each respective site), a combination of internet based advertising, referrals from community service agencies, a combination of web based and non-web based advertisements, from attendees of Women Infant and Children services and from the workplace.

There is a lot of heterogeneity across studies with regards to profile of study subjects. These have ranged from problem drinkers to heavy or binge drinkers. Furthermore definitions of drinking used varied across the studies. Also the intensity and rigorosity of WBIs studied varied widely from low intensity interventions such as generalized online psycho-educational brochure to extensively tailored cumulative variants of an internet based intervention. Interestingly none of the studies have included pharmacological treatment either as an adjunct or a comparator. The outcome variables also varied across the studies. Some of the studies utilized some quantitative measure of alcohol consumption. Only a few compared binge pattern drinkers with non-binge drinking population. The assessment period also varied widely from a week to up to 12 months.

Only three of fourteen studies among adults found WBIs to be more effective in reducing alcohol consumption as compared to non-WBI or no intervention. Significantly better response was observed for WBIs (for at least some of the variables) in 10 out of 21 studies including students. While the current

review showed that interventions for college and university students are more effective than those for adult alcoholics, this result should be viewed with caution. It must be noted that the majority of the WBIs target college and university students who are still in the early stages of their drinking career. Among those, the heavy/problem drinkers are not necessarily dependent on alcohol. Furthermore, not all such interventions among college/university students have been found to be effective on all parameters assessed. Only 10 (out of 21) studies reported a favorable outcome.

Less than 50% of the studies compared two or more WBIs. Only two studies among adults and one among college students found a significant difference among different WBIs. In the two studies among adults web based self-help intervention (Drink Less) and web based training in a Moderate Drinking protocol with the use of the online resources of Moderation Management were found to be significantly better than online psycho-educational brochure and online Moderation Management resource, respectively. Among the college students, a WPNF was found to be better than a WE approach.

However, it remains to be assessed that which components of the WBIs are most effective. Also the cost-effectiveness analysis for these interventions was not included in any of the studies. Impact of interventions on the use of other psycho active substances was also not assessed. Furthermore whether the improvements observed in problem alcohol use lead to improved functioning or quality of life remains to be assessed.

WBIs focusing on alcohol use related problems can play an important role in addressing these problems. However, these interventions need to be studied systematically and rigorously to have a better understanding in this relatively newer intervention modality.

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