Electronic communication based interventions for hazardous young drinkers: A systematic review

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Highlights

- Within this systematic review, various modes of intervention delivery were discussed. Although most are Web-based, other modalities included text messaging, mobile phone apps and SNS, demonstrating the potential in reaching a large number of young people in a convenient and non-intrusive way.

- The ability to provide personalized feedback resulted in a reduction in (a) alcohol consumption (b) frequency of binge drinking and (c) drinking in a non-risky way

- Intervention length did not appear to have an impact on overall effectiveness

Abstract

Previous reviews have specifically looked at computer-based or Internet-based approaches. However, there has been no systematic review focused upon electronic communication based interventions for hazardous young drinkers.

Out of 3298 relevant citations, 13 papers consisting of 11 studies met the inclusion criteria. Effectiveness of intervention delivery was assessed using behavioural outcomes. Eight papers delivered interventions using the Web, three implemented text messaging, one used a mobile phone app and the remaining paper used a social networking site.

The ability to provide personalized electronic feedback resulted in a reduction in alcohol consumption, frequency of binge drinking, and drinking in a non-risky way. However, intervention length did not appear to have an impact on overall effectiveness.

Usage of text messaging and Social Network Sites (SNS) increased accessibility and ease of engaging in an intervention that is appealing and acceptable for young adults.

Abbreviations

SNS  Social Network Sites
SMS  Short Message Service
1. Introduction

Heavy episodic drinking is a significant public health concern, tending to peak in late adolescence and early adulthood (Gmel, Kuntsche & Rehm, 2010). A high prevalence of excessive alcohol consumption has been reported by young people in the UK, with first year students consuming an average of 18.9 units per week (males 24.0 units, females 15.4 units) (Bewick et al., 2008). One university has previously reported that over half of students have participated in binge drinking at least once in the previous week (Dodd et al., 2010).
As the number of those engaging in heavy episodic drinking is rapidly increasing (Kypri et al., 2005; McAlaney & McMahon, 2007), there is a disproportionate number of mortality and morbidity amongst young people through alcohol-related injuries (Anderson & Baumberg, 2006; Rehm et al., 2011). The increased affordability of alcohol (Rabinovich et al., 2009; The Information Centre, 2010), combined with a wider product range (Measham, 2006; Mintel International Group, 2005) and amended UK alcohol policies e.g. extension of opening hours (Office of Public Sector Information, 2003), has resulted in excessive alcohol consumption becoming the dominant trend within Western cultures (Farke & Anderson, 2007; Hibell et al., 2009), particularly student populations (D’Alessio, Biaocco & Laghi, 2006).

The term hazardous drinking is defined as the regular consumption of 5 units per day for men and 3 units per day for women (SIGN, 2014), or through less frequent sessions of binge drinking (NHS Choices, 2013). This pattern of alcohol consumption can increase someone’s risk of harm, resulting in physical or mental health consequences, whilst some would extend this definition to include social consequences (NICE, 2010a; WHO, 2016). Preventative measures and interventions have been identified as essential in order to reduce levels of hazardous alcohol consumption amongst younger adults.

There are a number of methods and recommendations for delivering alcohol interventions, consisting mainly of traditional face-to-face or group work sessions (NICE, 2010b). Evidence suggests that this technique is effective in reducing alcohol use of binge drinkers and levels of alcohol-related harm (Bernstein et al., 2010; Daeppen et al., 2011; Patton et al., 2014). This has also been demonstrated within group sessions (LaBrie et al., 2006), particularly when comparing motivational interviewing with information only sessions (LaChance et al., 2009).

From a global perspective there has been a 23.5% increase in alcohol consumption from 2001 to 2005 and worldwide, 3.3 million deaths every year result from harmful use of alcohol. This represents 5.9% of all deaths. Within the UK alcohol misuse has been estimated to cost £2.7 billion a year, and the estimated cost of alcohol-related harm upon society being £17-22 billion (Department of Health, 2013; NHS Information Centre, 2009). Interventions utilizing technology have demonstrated effectiveness in improving health outcomes across a number of domains: diabetes (Liang et al., 2011), smoking cessation (Free et al., 2011; Whittaker et al., 2012), obesity (Bacigalupo et al., 2013; Coons et al., 2012), and HIV (Mustanski et al., 2013). By delivering methods
via interactive devices such as mobile phones and personal electronic devices, a wider population can be targeted who may not have ordinarily been reached through traditional methods (Guse et al., 2012; Lee et al., 2014; Strecher et al., 2007). Mobile phone and internet technology are becoming increasingly integrated into society, as an estimated 40% of the world’s population have access to the internet, and the number of mobile broadband subscriptions will reach 2.3 billion globally by the end of 2015 (ITU, 2014). Consequently, utilising mobile and internet technology potentially can be a time and cost-effective method of delivery intervention, reaching a larger population.

Previous reviews have specifically investigated computer-based (Khadjesari et al., 2011) or Internet-based approaches (White et al., 2010), however, there has been no systematic review focused upon electronic communication based interventions for hazardous young drinkers. Such a review is therefore timely.

**Objective**

To review the efficacy of electronic based communication interventions for alcohol misuse amongst hazardous young drinkers.

**2. Methods**

**Literature Search**

Systematic searches of Web of Science, PsycINFO and Scopus were conducted for English abstracts published (except dissertations) between January 2010 and January 2016. This specified time frame was selected as a review analysing similar papers of interest was conducted in 2010 (White et al., 2010). The terms: (1) alcohol; (2) computer, online; (3) Internet, Web; (4) text message; (5) AND intervention; (6) AND young adult, student were used to search for relevant studies. The quality of papers was assessed using the Cochrane Collaboration’s Tool for Assessing Risk of Bias, enabling reviewers to consider the potential limitations of the included studies, in relation to its design, conduct, analysis and presentation (Higgins et al., 2011). This comprehensive and well-disseminated approach has demonstrated empirical evidence for detection bias, attrition bias, and reporting bias (Higgins & Green, 2008).

**Inclusion criteria**
Study design
Quantitative studies were included. Specifically, only randomised controlled trials and cohort studies with comparison groups were considered. Comparison groups consisted of treatment as usual, placebo groups, and no intervention groups.

Populations
Those who were screened as being hazardous drinkers with the use of validated alcohol screening tools before intervention delivery were included. Hazardous drinking is defined as the regular consumption of 5 units per day for men and 3 units per day for women (SIGN, 2014), or through less frequent sessions of binge drinking (NHS Choices, 2013). This pattern of alcohol consumption can result in an increase in someone’s risk of harm, (physical, mental health, or even social consequences) (NICE, 2010; WHO, 2016). Samples comprising of both males and females, aged 18-25 years old were included within this study.

Interventions
Behavioural interventions delivered via electronic communication methods: (1) Web-based; (2) email; (3) text messages (SMS) and (MMS) and; (4) Social Network Sites (SNS).

Outcomes
Studies measuring behavioural outcomes, consisting of both short- and long-term outcome measures.

Exclusion criteria
Studies were excluded if they contained the following features: (i) mixed methodology (ii) individuals already in treatment for alcohol misuse; (iii) interventions requiring human involvement (e.g., researcher, psychologist) and (iv) interventions targeting specific sub-populations. All dissertations were excluded and articles not written in English.

3. Results
A total of 3298 potentially relevant citations were found. The majority of these citations were unsuitable for this review, focusing on a combination of health behaviours and gender-specific interventions, or designed for the general population or alcohol dependent individuals. Following
extraction of 538 duplicates and pieces of grey literature, the abstracts of 73 studies were examined further for more information. Two papers were removed due to the intervention focusing on a range of health behaviours (Cameron et al., 2015; Epton et al., 2014). The utilisation of mixed methods was not part of this review’s inclusion criteria (Fraeyman et al., 2012), as was the use of therapist involvement (Postel et al., 2010). One paper specifically discussed the use of behaviour change techniques (Garnett et al., 2015), whilst another focused upon the use of a screening tool (Winters et al., 2011).

The full papers of the remaining 64 studies were examined in order to confirm eligibility. Twenty-two papers were excluded due to lack of screening before intervention delivery (Bendtsen et al., 2012; Bingham et al., 2010; Bingham et al., 2011; Collins et al., 2014; Donovan et al., 2015; Fazzino et al., 2015; Foster, Neighbors & Pai, 2015; Hagger, Lonsdale & Chatzisarantis, 2012; Haug et al., 2013; Hustad et al., 2010; Jouriles et al., 2010; LaBrie et al., 2013; Lovecchio, Wyatt & DeJong, 2010; Murphy et al., 2010; Neighbors et al., 2010; Paschall et al., 2011a; Paschall et al., 2011b; Schuckit et al., 2012; Schuckit et al., 2015; Strohman et al., 2015; Weaver et al., 2014; Wyatt, DeJong & Dixon, 2013).

A further 16 studies did not meet the age range criteria (Bewick et al., 2013; Enggasser et al., 2015; Sinadinovic et al., 2014., Bendtsen & Bendtsen, 2014., Bendtsen et al., 2015; Bewick et al., 2010; Doumas et al., 2014; Ekman et al., 2011; Kypri et al., 2010; Kypri et al., 2013; Lotfipour et al., 2013; McCambridge et al., 2013; Moreira, Oskrochi & Foxcroft, 2012; Schulz, Kremers & de Vries, 2012; Schulz et al., 2013; Tensil, Jonas & Strüber, 2013). Four papers were simply commentaries on other studies, or reviews (Cronce et al., 2014; Hustad & Borsari, 2010; Naimi & Cole, 2014; Rodriguez et al., 2015), whilst one study discussed the method of designing a behaviour change intervention (Voogt et al., 2014c), resulting in exclusion from this review. A further 4 papers did not include a treatment control condition (Alfonso, 2015; Bryant, Henslee & Correia, 2013; Canale et al., 2015; Wodarski, MacMaster & Miller, 2012). Two papers used the same sample (Suffoletto et al., 2014; Voogt et al., 2013a) as other papers included within this review, thus were removed. Studies utilising a mixed methodology (Moore et al., 2013), human involvement in the intervention (Wagener et al., 2012) or targeting specific sub-populations, ranging from athletes (Martens et al., 2010) to mandated college students (Reid et al., 2015) were also excluded. Consequently, 13 papers were reviewed in this study, consisting of 11 studies.
Study characteristics

In total, 13 papers were included from 11 studies (see Table 1) representing a range of methods of intervention delivery. Six used web-based intervention approaches, whilst the remainder applied text messages, mobile phone apps and SNS in order to deliver alcohol interventions. Outcome measures predominantly focused upon frequency of alcohol consumption, normative beliefs about alcohol, and behavioural intentions. Baseline measures were taken in all 11 studies, however, length of follow-up varied from 1 month to 12 months.

The delivery of interventions falls into four main areas.

1. Web-based interventions

Nine papers discussed delivering interventions using the Web, varying in length from 5 minutes to 35 minutes. Personalised feedback was found to reduce possible effectiveness among specific subgroups of students (Cunningham et al., 2012; Palfai, Zisserson & Saitz, 2011), with some evidence to suggest that this type of feedback could prevent the uptake of alcohol among those who do not drink (Palfai et al., 2014). Hester et al.,’s (2012) study comprising of personalised feedback along with decisional balance exercises, social norms and risk factors, found that reductions in drinking and alcohol-related problems tended to be significantly greater in the intervention group compared to the assessment only control group ($p < .01$).

Kypri et al.,’s (2014) study consisting of personalised feedback indicated a slight reduction in the amount consumed per typical drinking occasion, providing support that a brief intervention can have some impact upon alcohol consumption (Kaner et al., 2007). However, there was no decrease in the frequency of drinking, overall volume consumed, or in related academic problems.

Although some of these studies demonstrated a number of strengths, achieving a diverse selection of student population and drinking cultures (Kypri et al., 2014), utilising a randomised controlled design (Hester et al., 2012), and achieving high retention rates (Palfai, Zisserson & Saitz, 2011), some had issues of being underpowered (Cunningham et al., 2012), and potential social desirability bias (Hester et al., 2012)
Improving knowledge, self-efficacy and awareness of social norms was found to significantly reduce weekly alcohol consumption (Voogt et al., 2014b), and was particularly effective in lowering drinking levels for subgroups of heavy drinking students in the short-term (Voogt et al., 2013b). It was also found that those in the experimental condition experienced higher social pressure Drinking Refusal Self-Efficacy (DRSE) compared to participants in the control condition, which was sustained after 6 months (Voogt et al., 2014a).

Voogt et al., (2013b; 2014a; 2014b) employed a rigorous methodology throughout each of the 3 papers. A high retention rate of the large sample size ($N = 907$) ensured stable findings and the ability to detect significant differences, however, the generalisability of the study is reduced by the university specific population and convenience sampling strategy. Long outcome measures of 6 months were implemented, providing an enhanced knowledge of the lasting effects of the intervention.

2. Text message

Automated text messages were found to have positive effects in the 3 papers included in this review. Personalised interventions, including tailored feedback and prompts, was associated with an increase in willingness to reduce alcohol use (Mason et al., 2014), and a reduction in the number of Heavy Drinking Days (HDD) and Drinks Per Drinking Day (DPDD) (Suffoletto et al., 2012; Suffoletto et al., 2015). However, it was found that self-monitoring alone was not effective at decreasing alcohol consumption (Suffoletto et al., 2015).

Although one study used a small sample size ($N = 18$) (Mason et al., 2014), thus limiting the ability to detect significance, Suffoletto et al., (2015) employed a diverse and substantial sample size ($N = 765$) with a 9-month follow-up, providing a better understanding of this method of intervention delivery. Overall, this approach was well received by participants, as 93% of those in the assessment and intervention groups replied to weekly drinking queries at least once over the 12 week period (Suffoletto et al., 2012), whilst approximately 33% of participants completed all text queries in Suffoletto et al.,’s (2015) study. However, there are risks of self-selection bias (Mason et al., 2014; Suffoletto et al., 2012), and recall and social desirability bias (Suffoletto et al., 2015) as only self-report were used.
3. Mobile Phone App
Gajecki et al., (2014) delivered an alcohol intervention through the use of two smartphone apps; (1) Promillekol app (tr. “Check your BAC”) and (2) PartyPlanner app. The Promillekol app enabled users to register alcohol consumption in real time, along with information on risky levels of estimated blood alcohol concentration (eBAC), and strategies to maintain alcohol consumption at a non-harmful level. The PartyPlanner app also allowed users to register alcohol consumption in real time, as well as simulate an event where alcohol would be consumed ahead of time. During a drinking occasion, the app displayed the eBAC level with colour codes indicating a risky level.

No significant time-by-group interactions for any outcome measures were found for the PartyPlanner group, whereas male Promillekol participants reported an increase in their drinking frequency, but not larger quantities, at follow-up ($p = 0.001$). Attrition rates were relatively low in this large study ($N = 1929$). Significant differences in attrition rates were demonstrated between the two smartphone apps. Outcomes were self-reported in this study, and although computerised data collection may minimise social desirability bias (Booth-Kewley, Larson & Miyoshi, 2007; Gnambs & Kaspar, 2014). There is a need to study the validity of self-reported data in brief alcohol intervention trials to increase reassurance of the effects reported (Northcote & Livingston, 2011).

4. Social Networking Site
One study (Ridout et al., 2014) delivered an alcohol intervention through an SNS, providing social norms feedback through the website’s private messaging facility, 1 week following a screening questionnaire. Statements included the comparison of participants’ perceptions of classmates’ use and approval of alcohol use, with actual descriptive and social norms calculated from their classmates’ survey questionnaire responses. In order to demonstrate their level of understanding of these statements, participants were required to complete an online form detailing their interpretation of the figures they received regarding their own and their classmates’ alcohol use and approval of heavy drinking. The research team addressed any errors in the participants’ responses with immediate follow-up through a second private message.

Results indicated that the intervention group improved their accuracy of social norms significantly more than the control group on three of the four social norms questions at 3 months follow-up. It
was also found that the intervention group reduced their monthly drinking quantity and frequency at follow-up significantly more compared with the control group ($P < 0.01$). These findings are similar to that of Bryant et al.,’s (2013), whereby personalised feedback results in a significant reduction in the number of drinks consumed per week. The study employed a rigorous methodology; however, 80% of the sample consisted of women, limiting the generalisability of the findings. Furthermore, there is a high risk of self-selecting bias, as respondents received course credits for participating in the follow-up surveys.

**Quality Rating**

Quality of the 13 papers was assessed using the Cochrane Collaboration’s Tool for Assessing Risk of Bias, in accordance with Higgins and Altman’s (2008) approach. The majority of papers had some element of risk of bias, particularly with regards to the following domains (i) blinding, (ii) allocation concealment and, (iii) adequate sequence allocation, which raises some doubt about the results. A high risk of bias was found in the domain, free of other bias, across a number of papers, which may alter the results seriously. The results are presented in Table 2.

**Insert Table 2 Here**

**4. Discussion**

Within this systematic review, various modes of intervention delivery were discussed. Although most are Web-based, other modalities included text messaging, mobile phone apps and SNS, demonstrating the potential in reaching a large number of young people in a convenient and non-intrusive way.

Intervention length did not appear to have an impact on overall effectiveness. The web-based approaches included within this review varied in duration, however, all produced a moderate effect on drinking amongst a specific subgroup sample. Modalities delivering interventions over an ongoing period, ranging from a number of days to several weeks, were effective in reducing frequency of drinking. Due to the real time and pervasive aspects of mobile technology, delivering
interventions via this approach may act as a regular prompt and additional support in maintaining behaviour change (Dowshen et al., 2012; Nundy et al., 2013; Rodgers et al., 2005; Shaw et al., 2013).

The ability to provide personalized feedback resulted in a reduction in alcohol consumption (Kypri et al., 2014), frequency of binge drinking (Voogt et al., 2014b), and drinking in a non-risky way (Suffoletto et al., 2015). Addressing the varying knowledge gaps of young people through an adaptable and tailored intervention is evidently effective; as this can help individuals better understand their own drinking behaviours and the associated health risks. Research indicates that targeting interventions for young adults is important developmentally, as psychosocial capacities that improve decision making and moderate risk taking are not fully developed until the age of 25 (Kelley, Schochet & Landry, 2004; Steinberg, 2004; Steinberg, 2007). Consequently, tailored interventions can serve to prevent individuals from further alcohol-related harm, or as some studies have found, prevent the uptake of alcohol amongst non-drinking students (Palfai et al., 2014).

College and university students tend to misperceive their peer norms by overestimating the amount of alcohol consumed by peers (Mcalaney & McMahon, 2007). Preliminary findings from Ridout et al.,’s (2014) social networking study found correcting misperceptions of peer drinking norms reduced monthly drinking quantity and frequency at 3 month follow-up. Additional factors have also been found to negatively impact upon alcohol use, such as peer pressure (Trucco et al., 2011), tolerant community norms (Kuntsche, Kuendig & Gmel, 2008; Song et al., 2012), and exposure to alcohol advertising (Jones & Magee, 2011; Smith & Foxcroft, 2007). A large body of evidence has demonstrated that the need to correct misperceptions is essential across a broad range of populations and health behaviours e.g. sun protection (Reid & Aiken, 2013), vaccinations (Nyhan & Reifler, 2015), breastfeeding (Reinsma et al., 2015) and obesity (Duncan et al., 2011). Consequently, identifying misperceptions and rectifying them through modern technology would appear to provide an opportunity to overcome barriers associated with more traditional modes of programme delivery.

Research indicates that interventions, to reduce alcohol consumption, based on mobile phone apps are associated with more weight loss than other types of interventions (Mateo et al., 2015), and significantly higher rates of abstinence (Ubhi et al., 2015). Interestingly, the implementation of a mobile phone app had very little effect on overall alcohol consumption, and in the case of the Promillekol app, frequency of drinking increased amongst male participants (Gajecki et al., 2014). The significant difference between attrition rates of the two smartphone apps highlights the possible
importance of app content and design. Consequently, the need for both appealing features and low burden is essential in order for apps to be used over an extended period of time (Dennison et al., 2013).

Interactive interventions have been found to successfully maintain behavioural change (Aneja et al., 2012; Williams et al., 2012). The act of responding to a series of text messages resulted in a decrease in the number of Heavy Drinking Days and maximum drinks per drinking days (Suffoletto et al., 2012; Suffoletto et al., 2015), whilst booster texts increased intentions to reduce alcohol use (Mason et al., 2014). Consequently, a more interactive approach may prompt the individual to actively consider their current drinking behaviour, almost acting as a ‘teachable moment’, whereby behaviour change is triggered by a specific event, experience, or as a consequence of risky behaviour (Boudreaux, Bock & O’Hea, 2012).

The preference for using mobile technology was highlighted in Cunningham et al.,’s (2012) study, whereby 27% of respondents accessing the web-based intervention did so by using a mobile phone platform, even though the personalized feedback intervention was designed to be completed in a computer-based environment. This is supported by the high response rate in Suffoletto et al.,’s (2012) text message intervention, as 80% of respondents in the intervention group completed the 12 week study, indicating the ease and accessibility of mobile phones are favoured by young people. Additionally, an eHealth app developed by Carrà et al., (2015), (D-ARIANNA, Digital-Alcohol Risk Alertness Notifying Network for Adolescents and young adults), incorporated evidence-based risk/protective factors in order to develop a risk estimation model for binge drinking in young people. There was a noted reduction in binge drinking following the use of the app (Carrà et al., 2016), and the findings of this study provide further support for the acceptability of mobile technology, as a response rate of 82% was achieved, with 98% of participants reporting that the eHealth app was easy to use (Carrà et al., 2015). A wealth of evidence demonstrates that electronic communication based interventions are widely accepted by both young people (Britto et al., 2012; Dennison et al., 2013; Lim et al., 2012) and a number of other population groups (Arora et al., 2012; Patrick et al., 2009; Proudfoot et al., 2010). This would indicate that the high acceptability rate of mobile technologies may result in a higher engagement, as supported by the findings in this review.

Limitations
Due to the varying methodologies and heterogeneity of outcome measures, accurate comparisons are difficult, particularly as one study within this review contained very small sample sizes. Only 3 studies obtained follow-up measures at 6 months or longer, resulting in an insufficient assessment of sustainability of the interventions, due to the lack of long-term follow-up. Four studies (Mason et al., 2014; Ridout et al., 2014; Suffoletto et al., 2012; Suffoletto et al., 2015) reported detailed demographic characteristics of the participants, providing little insight as to whether or not minority groups were reached in the remaining 7 studies. The majority of studies comprised of university students only, a specific sample tending to be heavier drinkers than their non-university peers (Carter, Obremski-Brandon & Goldman 2010; Dawson et al., 2004; Kypri & McAnally, 2005), resulting in a lack of generalisability to the general young adult population.

Studies employing more interactive methods of intervention delivery (Mason et al., 2014; Suffoletto et al., 2015), potentially attracted individuals more motivated to address personal drinking behaviour, resulting in a self-selecting sample. Additionally, the high rate of follow-up reported by several studies may be due to incentives (Ridout et al., 2014), making attitudes of interventions difficult to assess.

5. Conclusion
The array of intervention modalities highlights the flexibility that technology has in delivering alcohol interventions for young people. This adaptability by introducing more interactive approaches, such as text messaging, email and SNS resulted in significant reductions in frequency of drinking, indicating that the increased accessibility and ease of engaging in the intervention is appealing and acceptable for young adults.

Due to the relatively low cost and convenience of mobile technology, there is potential for a larger proportion of the population to be accessed, including smaller minorities who would otherwise not be reached through traditional methods. However, as the majority of the studies included within this review did not explicitly report participant demographics, this is inconclusive. More research is needed on longer-term follow-ups with well-validated outcome measures, that are explicitly stated, to identify whether such modes of delivery can sustain an effect over time. The appropriateness of outcome measures requires attention to reflect the intervention focus and for consideration of adopting clinical interviewing and physiological confirmation (e.g. urine liver function testing).
There is also a need for young people’s attitudes to be explored regarding the use of interactive technology, including the type of modality, level of contact and length of intervention overall.

**Conflicts of Interest**
None

**Acknowledgement**
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References


intake: a multisite investigation. *Journal of Medical Internet Research, 12*(5). e59. doi: 10.2196/jmir.1461


Figure 1: Study identification and analysis flow diagram

Relevant citations
N = 3298

Inclusion criteria not met
N = 2687

Relevant titles
N = 611

Duplicates (N = 532)
Grey literature (N = 7)

Abstracts examined further
N = 72

Studies excluded after abstracts did not meet inclusion criteria
N = 9
Reasons for exclusion:
• Not within age range (N=3)
• Mixed health intervention (N=2)
• Intervention focus (N=2)
• Therapist involvement (N=1)
• Mixed methodology (N=1)

Full papers examined
N = 63

Studies excluded after full papers did not meet inclusion criteria
N = 50
• No screening before intervention (N=22)
• Not within age range (N=13)
• No control condition (N=4)
• Commentary/review (N=4)
• Same study sample (N=2)
• Specific sub-population (N=2)
• Intervention focus (N=1)
• Human involvement (N=1)
• Mixed methodology (N=1)

Total papers included in review
N = 13
<table>
<thead>
<tr>
<th>Author and location</th>
<th>Participant demographics</th>
<th>Intervention content and groups</th>
<th>Outcome measures and follow-up</th>
<th>Reported results</th>
<th>Summary of findings</th>
</tr>
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<tbody>
<tr>
<td>Cunningham et al., 2012 USA</td>
<td>N = 425 52.5% male M(SD)=22.6(3.9)</td>
<td>Two conditions: 1. Web-based assessment, personalized feedback (5 minutes) 2. No intervention</td>
<td>AUDIT-C Measured at baseline and 6 weeks.</td>
<td>No significant differences between condition and intervention (p &gt; .05).</td>
<td>“…web-based feedback...most effective among specific subgroup of students...who view their drinking as problematic and/or who are considering changing their drinking.”</td>
</tr>
<tr>
<td>Gajecki et al., 2014 Sweden</td>
<td>N = 1929 48.3% male M(SD)=24.7(4.8)</td>
<td>Three conditions: 1. Promillekoll mobile phone app 2. PartyPlanner mobile phone app 3. Control: No intervention</td>
<td>AUDIT; Daily Drinking Questionnaire (DDQ). Measured at baseline and 7 weeks.</td>
<td>No significant time-by-group interactions for outcome measures in PartyPlanner group. Promillekoll app users showed a significant increase in drinking frequency compared to control (p = .001).</td>
<td>“…participation...did not seem to affect drinking in any of the three study groups. However...Promillekoll app... associated with a negative effect in the form of an increased number of drinking occasions over one week.” “eBAC in the app form is not effective for reducing alcohol consumption among university students.”</td>
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<tr>
<td>Hester, Delaney &amp; Campbell, 2012 USA</td>
<td>Experiment 1 N = 144</td>
<td>Experiment 1 Two conditions: 1. Web-based intervention (35 minutes) 2. Assessment only</td>
<td>Experiment 1 AUDIT; BDP (Brief Drinker's Profile); CSAP (College Students Alcohol Problems). Measured at baseline, 1 and 12 months.</td>
<td>Experiment 1 Reductions in drinking and alcohol-related problems in the intervention group tended to be greater than that in the control group.</td>
<td>Experiment 1 “...modest support...that...experimental group would show lower levels of drinking and alcohol-related problems relative to the control group at follow-ups.”</td>
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<td></td>
<td>Experiment 2 N = 82</td>
<td>Experiment 2 Two conditions: 1. Web-based intervention (35 minutes) 2. Delayed assessment</td>
<td>Experiment 2 AUDIT; BDP (Brief Drinker's Profile); CSAP (College Students Alcohol Problems). Measured at baseline and 1 month.</td>
<td>Experiment 2 Control group showed no improvement from baseline to 1-month on Drinks per Week or on Peak BAC in a typical week.</td>
<td>Experiment 2 “...experimental group show lower levels of drinking relative to the control group at follow-up.”</td>
</tr>
<tr>
<td>Kypri et al., 2014 New Zealand</td>
<td>N = 3422 42% male Intervention M(SD)=20.2(1.8) Control M(SD)=20.1(1.7)</td>
<td>Two conditions: 1. Web-based assessment and personalized feedback (10 minutes) 2. Screening only</td>
<td>AUDIT-C; AREAS (Academic Role Expectations and Alcohol Scale); Drinking Frequency; Number of Drinks per Occasion; Weekly Volume of Drinks, Binge Drinking and Heavy Drinking Indicators. Measured at baseline and 5 months.</td>
<td>Intervention produced reduction in amount consumed per drinking occasion (p = .005), but not in frequency of drinking, overall volume consumed, or related academic problems.</td>
<td>“…web-based alcohol screening and brief intervention program resulted in... a small reduction in the amount consumed in a typical drinking occasion but not in other alcohol consumption and problem measure.”</td>
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<tr>
<td>Study</td>
<td>Sample</td>
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<tr>
<td>Mason et al., 2014 USA</td>
<td>N = 18</td>
<td>44% male</td>
<td>M(SD)=19.2(1.3)</td>
<td>Four days. Two conditions: 1. Text messages (4-6) daily plus booster texts. 2. No intervention</td>
<td>AUDIT; 12-item Brief Symptom Inventory; Substance Use; 12-item Drinking Expectancy Questionnaire; SOCRATES (Stages of Change Readiness and Treatment Eagerness Scale). Measured at baseline and 1 month. Both groups reported drinking less at 1 month. Intervention increased readiness to change and intentions to reduce alcohol use, whereas control group decreased in readiness and intentions to reduce alcohol use. “...ability to reach populations of interest at an extremely low cost has implications for...public health...” “...MI-based intervention activated participants’ motivation for change...subsequently...reevaluating their drinking behaviour.”</td>
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<tr>
<td>Palfai, Zisserson &amp; Saiz, 2011 USA</td>
<td>N = 119</td>
<td>30% male</td>
<td>M(SD)=18.6 (1.4)</td>
<td>Two conditions: 1. Web-based personalized feedback 2. Control: guidelines for sleep and consumption of fruit and vegetables</td>
<td>AUDIT; Daily Drinking Questionnaire-Modified (DDQM); Young Adult Alcohol Problems Screening Test-36 (YAAPST-36); Drinking Motives Questionnaire; Alcohol Outcome Expectancy Scale; Readiness to Change Questionnaire; Alcohol Use Discrepancy. Measured at baseline and 1 month. Students with high levels of alcohol-related consequences exhibited significantly less drinking when exposed to intervention (p &lt; .05). “...providing web-based personalized feedback about alcohol use and consequences...particularly effective strategy for reducing alcohol use among hazardous drinking students who have experienced high levels of alcohol-related negative consequences.”</td>
</tr>
<tr>
<td>Palfai et al., 2014 USA</td>
<td>N = 695</td>
<td>33% male</td>
<td>M(SD)=18.21 (1.46)</td>
<td>Two conditions: 1. Web-based personalized feedback (15 minutes) 2. Control: general health feedback</td>
<td>AUDIT; Frequency of Heavy Episodic Drinking; Typical Quantity per Week; Young Adult Alcohol Consequences Questionnaire (YAACQ). Measured at baseline and 5 months. No significant effect of intervention on past-month heavy drinking episodes and 5 month follow-up on number of negative consequences reported. “Although...no significant overall effects of the intervention...analyses among the non-drinking sample provided suggestive evidence...that this intervention may prevent the uptake of alcohol among students who do not drink.”</td>
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<tr>
<td>Ridout &amp; Campbell, 2014 Australia</td>
<td>N = 95</td>
<td>22% male</td>
<td>M(SD)=19.05 (1.78)</td>
<td>Two conditions: 1. Social networking site (SNS) - feedback 2. No intervention</td>
<td>AUDIT; GF (Graduated Frequency Measure); Social Norms. Measured at baseline, 1 and 3 months. Intervention reduced monthly drinking quantity and frequency (p &lt; 0.01) at follow-ups. Intervention improved accuracy significantly more than the control on three of the four social norms (p &lt; .05; p &lt; .001; p &lt; .01). “...correcting misperceptions regarding...prevalence and social approval of binge drinking using SNS is an inexpensive and effective strategy...potentially bring widespread benefit to university populations.”</td>
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<tr>
<td>Suffoletto et al., 2012 USA</td>
<td>N = 45</td>
<td>36% male</td>
<td>M(SD) = 21 (1.8)</td>
<td>Twelve weeks. Automated text messages Three conditions: 1. Assessment of alcohol consumption 2. Feedback and goal setting 3. Final survey reminder</td>
<td>AUDIT-C; Drinks Per Drinking Day (DPDD); Heavy Drinking Days (HDD); Rutgers Alcohol Problem Index (RAPI). Measured at baseline and 3 months. Group 1 had HDD 69% of the time, compared with 58% in Group 2. Setting a goal &gt;50% of the time they were prompted, had average of 2.7 weeks with HDD, vs. 5.4 weeks with HDD in those who set goals ≤50% of the time. “Exposure to TM-based feedback was associated with a decrease in the number of HDDs and DPDD.” “...intervention has the ability to provide TM-based feedback and support at a large scale with minimal cost.”</td>
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<tr>
<td>Suffoletto et al., 2015</td>
<td>N = 765</td>
<td>SA+F (N=384)</td>
<td></td>
<td>Twelve weeks. Two-way text message</td>
<td>AUDIT-C; Self-reported Binge Drinking Days; Binge Drinking</td>
</tr>
</tbody>
</table>
| USA | 34.6% male  
M(SD)= 22(2.0)  
SA (N=196)  
36.2% male  
M(SD)=22(2.0)  
Control (N=185)  
33% male  
M(SD)=21.8(2.1) | sessions.  
Three conditions:  
1. SMS assessment +  
Feedback intervention (SA+F)  
2. SMS assessment  
3. No SMS assessment  
Prevalence over past 30 days; Drinks per Drinking Day; Alcohol-related Injury Prevalence over past 3 months.  
Measured at baseline, 3, 6 and 9 months.  
with SA+F participants reporting less drinking across all measured alcohol consumption outcomes when compared to control participants.  
No significant reductions in alcohol-related outcomes when comparing SA participants to control.  
| alcohol consumption in a diverse sample of young adults.”  
“…SMS messages can provide a “cue to action” when self-regulation processes are most vulnerable.” |
| --- | --- | --- | --- |
| Voogt et al., 2013b  
The Netherlands | N = 907,  
60.2% male  
M(SD) = 20.8 (1.7) | Two conditions:  
1. Web-based intervention (20 minutes).  
2. No intervention  
AUDIT; Heavy Drinking; Frequency of Binge Drinking; Dutch version of the Alcohol Weekly Recall; Readiness to Change.  
Measured at baseline, 1 and 6 months.  
No significant differences between conditions in heavy drinking, frequency of binge drinking, weekly alcohol consumption (p > .05).  
| “…intervention…not effective in reducing heavy drinking, frequency of binge and weekly alcohol consumption among heavy drinking students at 1- and 6-month post-intervention.  
However…effective in lowering drinking levels for subgroups of heavy drinking students in the short term.” |
| Voogt et al., 2014a  
The Netherlands | N = 907,  
60.3% male  
M(SD) = 20.8 (1.7) | Two conditions:  
1. Web-based intervention (20 minutes).  
2. No intervention  
AUDIT; Dutch version of Alcohol Weekly Recall; Binge Drinking Frequency; Drinking Refusal Self-Efficacy Questionnaire Revised Adolescents Version (DRSEQ-RA)  
Measured at baseline and 6 months.  
Participants gradually reduced their consumption over time.  
| “…experimental condition experienced a higher social pressure DRSE compared to…control condition…that sustained at six-months follow-up.” |
| Voogt et al., 2014b  
The Netherlands | N = 907,  
60.3% male  
M(SD) = 20.8 (1.7) | Two conditions:  
1. Web-based intervention (20 minutes).  
2. No intervention  
AUDIT; Dutch version of the Alcohol Weekly Recall; Frequency of Binge Drinking  
Measured at baseline, 1, 3 and 6 months.  
Participants reduced consumption of alcohol and frequency of binge drinking throughout 6 months (p < .001).  
| “…intervention…effective in preventing an increase in weekly alcohol consumption and frequency of binge drinking…among heavy-drinking students that was sustained at 3 and 6 months post intervention.” |
Table 2: Quality Rating Summary for Included Studies

<table>
<thead>
<tr>
<th>Study</th>
<th>Adequate sequence allocation</th>
<th>Allocation concealment</th>
<th>Blinding</th>
<th>Incomplete outcome data addressed</th>
<th>Free of selective reporting</th>
<th>Free of other bias</th>
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<td>Cunningham et al., 2012</td>
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