20

Electronic Brief Personalised Feedback Interventions for Alcohol Use

Bridgette M. Bewick, Robert C. Dempsey, John McAlaney, and Helen F. Crosby

Introduction

Developing and implementing effective interventions to prevent and intervene with harmful alcohol use remains imperative if the global burden of alcohol-related harms is to be reduced and the lives of those affected improved. Excessive alcohol consumption remains a significant public health problem. Worldwide, three million deaths every year are attributed to the harmful use of alcohol (World Health Organization (WHO), 2018). Harmful use is linked to 200 health conditions, including liver disease, cardiovascular diseases, and poor mental health (WHO, 2018). The misuse of alcohol has

B. M. Bewick (✉)
School of Medicine, University of Leeds, Leeds, UK
e-mail: b.m.bewick@leeds.ac.uk

R. C. Dempsey
Department of Psychology, Manchester Metropolitan University, Manchester, UK
e-mail: r.dempsey@mmu.ac.uk

J. McAlaney
Faculty of Science and Technology, Bournemouth University, Bournemouth, UK
e-mail: jmcalaney@bournemouth.ac.uk

H. F. Crosby
School of Social and Health Sciences, Leeds Trinity University, Leeds, UK
e-mail: h.crosby@leedstrinity.ac.uk

negative health and social consequences for the individual and wider society. The WHO aims to cut the harmful use of alcohol by 10% by 2025 (WHO, 2018). Recent evidence suggests this target is unlikely to be met; instead, it appears that annual consumption of alcohol globally is on the increase (Manthey et al., 2019).

Brief alcohol interventions offer one means of intervening to reduce and avoid harmful alcohol use. Brief interventions generally include a focus on individuals' beliefs and attitudes, their self-efficacy, and a focus on how an individual's behaviour or attitude compares to other people's (Kaner & Bewick, 2011). Brief alcohol interventions differ in their mode of delivery, intervention content, and duration. For example, they may be delivered in a single (e.g. Acuff et al., 2019) or multiple sessions (e.g. Liu et al., 2011), on an individual (e.g. Carey, Carey, Maisto, & Henson, 2006) or group basis (e.g. Kenney, Napper, LaBrie, & Martens, 2014). They may include personalised normative feedback (e.g. Wilke, Mennicke, Howell, & Magnuson, 2014), motivational interviewing (e.g. Daeppen et al., 2011), or cognitive behavioural therapy (e.g. Marques & Formigoni, 2001). Despite growing evidence for the effectiveness of brief alcohol interventions for reducing harmful alcohol use (Angus, Latimer, Preston, Li, & Purshouse, 2014; Kaner et al., 2009; Platt et al., 2016), their impact on the prevalence of harmful alcohol use is unexpectedly low (Riper et al., 2018). In part this is due to the challenge of successfully implementing brief alcohol interventions. Traditional, human-supported brief alcohol interventions can be costly, labour intensive, and difficult to implement on a large-scale (Carey, Scott-Sheldon, Carey, & DeMartini, 2007). Electronic brief alcohol interventions may address some of these challenges. The aim of this chapter is to review the intervention content, evidence base, effectiveness, future challenges, and opportunities associated with the use of electronic brief interventions for alcohol.

Electronic Brief Alcohol Interventions

The development of the ubiquitous internet affords an opportunity for scalability of electronic brief alcohol interventions, and their availability continues to increase over time (Riper et al., 2011). Time has also seen an increase in the quality of studies, with a marked increase in studies using randomised controlled trials (Cunningham, Khadjesari, Bewick, & Riper, 2010). Electronic brief alcohol interventions provide several opportunities that are difficult to deliver with offline equivalents. For example, they are able to deliver interventions in ways that can be tailored to the individual and

reactive to their beliefs and behaviours. This differs from other forms of public health intervention that are more static or passive in nature. For example, a mass media campaign to reduce harmful alcohol consumption through the use of posters and television adverts relies on the targeted individuals being exposed to intervention messages by passing by the poster locations or watching television during the selected television adverts. Even if a mass media campaign saturates the media channels of the target population, there are likely to be periods of time in which individuals will not encounter those media messages. This is largely outside of the control of the organisation or researchers who are delivering the intervention. Similarly, an individually targeted brief alcohol intervention typically requires a relatively high degree of commitment from the target population, such as attendance at a physical location or a fixed time window in which their participation must occur. Whilst this may be simpler to achieve in settings where individuals can to a degree be compelled to take part in activities or when dedicated time can be allocated for an activity this is not always feasible. Electronic brief alcohol interventions provide opportunities to overcome many of these obstacles, by enabling interventions to be delivered in a schedule and format that is set by the researcher or health organisation. This is especially the case if the electronic brief intervention is delivered or facilitated by smartphones, given the ubiquity of smartphone ownership in developed countries and the high frequency with which a typical smartphone user checks their device each day (Deloitte, 2018).

Personalised Feedback

One active ingredient of many electronic brief alcohol interventions is personalised feedback (Prosser, Gee, & Jone, 2018). The tailoring or personalisation of feedback is usually based on user characteristics (e.g. gender; Pedersen, Parast, Marshall, Schell, & Neighbors, 2017) or self-reported behaviour and attitudes (e.g. number of drinks consumed; Ridout & Campbell, 2014). Personalised feedback has been identified by the National Institute on Alcohol Abuse and Alcoholism (NIAAA) as being a component of the most effective strategies to reduce harmful alcohol consumption on college campuses (NIAAA, 2015). Personalised feedback may be effective for several reasons. People are driven to determine how we compare to those around us (Festinger, 1954). Personalised feedback can offer an approximation of how our alcohol consumption compares to others. In the case of social norms-based personalised feedback it may explicitly quantify how one's alcohol use compares to

their peers (Dempsey, McAlaney, & Bewick, 2018). People are motivated to seek out both positive and negative social information (Taylor, Bomyea, & Amir, 2010), which can be inferred from any personalised feedback that we may receive about our individual alcohol use. Alcohol use is an example of a behaviour that can be viewed by individuals as both a positive or negative social behaviour (e.g., Chap. 1, Sher, Bartholow, & Nanda, 2001) and, as such, individuals may engage with personalised feedback because they have an expectation of receiving either negative or positive social information.

The process of personalising the response means face-to-face delivery of personalised feedback is resource intensive because it involves asking individuals to report their past alcohol consumption before comparing this to gender-specific, population-level norms, and then feeding back to individuals how their consumption compares to these norms. As a result, it was not initially feasible to deliver human-generated personalised feedback on a larger scale or population level. Thus, at first personalised feedback interventions were only available in person for those accessing specialist services (Borsari & Carey, 2000). Technological advances mean personalised feedback can now be generated and sent automatically to larger groups of participants who may access their feedback more remotely. Complex algorithms instantly take information provided by the user and generate increasingly nuanced personalised feedback based on gender-specific population-level norms. For example, Bewick, Trusler et al. (2008) used data from a previous, university-wide, survey to inform feedback provided to university students in their intervention. Personalised feedback can be delivered as a standalone intervention or integrated with other active ingredients and behaviour change techniques, such as other motivational and self-regulatory interventions described in Chap. 21.

Evidence for Electronic Personalised Feedback Interventions

Population

Providing an aid for early identification, prevention, and intervention, electronic personalised feedback interventions are almost always targeted at individuals with problematic, or at risk of developing problematic drinking behaviour. Electronic personalised feedback interventions are particularly attractive for use in populations where help-seeking behaviour is relatively low, for example, college or university students (Wechsler et al., 2002),

emergency department patients (Suffoletto et al., 2015), and military personnel (Miller, DiBellow, Carey, & Pederson, 2018; Pemberton et al., 2011). Electronic personalised interventions are not a substitute for more intensive interventions required to address alcohol dependence. The low-intensity nature of electronic brief alcohol interventions that include personalised feedback render them appropriate for being delivered population-wide—for example, in a workplace (e.g. Doumas & Hannah, 2008).

The majority of studies investigating the effectiveness of electronic brief alcohol interventions that include personalised feedback or electronic personalised interventions have targeted high school (e.g. Ganz et al., 2018) and college/university students (e.g. Bewick et al., 2010; LaBrie et al., 2013). This evidence spans heterogeneous populations, including students from Brazil (Bedendo, Ferri, de Souza, Andrade, & Noto, 2019), Canada (e.g. Thompson, Burgess, & MacNevin, 2018), Germany (e.g. Ganz et al., 2018), New Zealand (e.g. Kypri, Saunders, & Gallagher, 2003), Sweden (e.g. Bendtsen, Bendtsen, Karlsson, White, & McCambridge, 2015), the United Kingdom (e.g. Bewick et al., 2010), and the United States (e.g. Neighbors et al., 2019; Strohman et al., 2016). The research literature has also paid particular attention to subpopulations of students who may be at higher risk for problematic alcohol use, including first-year students (e.g. Doumas & Andersen, 2009), student athletes (e.g. Doumas, Haustveit, & Coll, 2010), mandated college students (e.g. Dunn, Fried-Somerstein, Flori, Hall, & Dvorak, 2019), and students studying abroad (e.g. Pedersen, Neighbors, Atkins, Lee, & Larimer, 2017).

Delivery Mode

Early variants of electronic personalised feedback interventions delivered relatively static content using CD-ROM or PC installed software (Carey, Carey, Maisto, & Henson, 2009). These interventions were quickly superseded by interventions delivered via email and the World Wide Web (e.g., Doumas & Hannah, 2008); the latter now constitutes the majority of electronic personalised feedback interventions tested today. We are, however, seeing the rise of electronic personalised feedback interventions using text messages (e.g. Bernstein et al., 2018; Suffoletto et al., 2015), social networking media (e.g. Facebook; Ridout & Campbell, 2014), and smartphone applications (e.g. Bertholet, Godinho, & Cunningham, 2019; Crane, Garnett, Michie, West, & Brown, 2018). Such approaches reflect the fact that some individuals prefer to receive and complete interventions on their mobile phone or smartphone as opposed to completing an intervention using a desktop or laptop computer.

Duration of Intervention Test

Electronic brief alcohol interventions that include personalised feedback and electronic personalised feedback interventions vary substantially in the length of time users are expected to invest in the intervention. Some interventions are designed as very brief single sessions (e.g. Bewick, Trusler et al. 2008), and others deliver a series of interactions over a relatively brief period of time (e.g. two sets of text messages delivered over two days apart; Suffoletto et al., 2015). Some electronic brief alcohol interventions that include personalised feedback ask users to follow an entirely automated modular programme (e.g. Guillemont et al., 2017; Ingersoll et al., 2018). In a recent superiority randomised control trial, an effective electronic screening and brief intervention that included electronic personalised normative feedback was as effective as an extended internet intervention (Cunningham et al., 2017).

Intervention Content

Electronic personalised feedback interventions, by their very nature, always include some form of alcohol-related personalised feedback. The electronic personalised feedback interventions delivered to date have, however, varied in their use of normative or comparative feedback (e.g. to others' alcohol behaviour or attitudes), the inclusion of additional therapeutic interventions to promote behaviour change, and the targeting of a range of health-related behaviours in addition to alcohol use. Many electronic personalised feedback interventions also incorporate self-monitoring into their intervention design, both of which are established as effective techniques for behaviour change (National Institute for Health and Care Excellence (NICE), 2014).

Interventions based solely on personalised feedback often include personalised normative feedback (e.g. Neighbors et al., 2015). Personalised normative feedback includes information on both the individual's own drinking behaviour/attitude and information on how that behaviour/attitude compares to those in a salient peer group. Electronic personalised normative feedback can be tailored to specific norms, in terms of sex, ethnicity, and other more-context specific social norms (such as affiliation with student societies, e.g. LaBrie et al., 2013). These norms can be descriptive or injunctive norms (McAlaney, Bewick, & Hughes, 2011). Descriptive norms refer to how frequent or common a behaviour is believed to be, such as the perception that an individual has about how frequently and heavily their peers drink alcohol. Injunctive norms refer to beliefs about attitudes, such as if an individual

believes their peers to be supportive of drinking alcohol to the point of drunkenness (see Chap. 4 for more on descriptive and injunctive norms). Personalised feedback interventions that do not include these normative comparisons are also available. Such interventions present a summary of the users' own behaviour/attitude without presenting any comparative norms. They may also include information on consequences and behaviour modification techniques.

Personalised feedback is sometimes integrated into electronic brief alcohol interventions that include components from other therapeutic principles (i.e. integrated interventions). A recent review of brief interventions for alcohol use concluded that integrated interventions (that included personalised feedback) were more effective than standalone electronic personalised feedback interventions (Riper et al., 2018); Riper et al.'s review excluded student and pregnant populations and also excluded studies that included low-risk drinkers.

While many electronic brief alcohol interventions that include personalised feedback/electronic personalised feedback interventions target drinking behaviour as experienced on a 'regular' day there is a body of evidence seeking to understand if targeting particular events or occasions could be effective in reducing alcohol-related harms. For example, one could target students who are about to turn 21 years of age (e.g. Bernstein et al., 2018) or those attending Mardi Gras (e.g. Buckner, Neighbors, Walukevich-Dienst, & Young, 2019).

The majority of electronic brief alcohol interventions that include personalised feedback/electronic personalised feedback interventions have alcohol as their only behavioural target. It is however possible to deliver e-interventions that target multiple behaviours. For example, Parekh, King, Boyle, and Vandelanotte (2014) created a computer-tailored intervention that included personalised feedback for diet, smoking, alcohol, physical activity, and body mass index. Aharonovich, Stohl, Cannizzaro, and Hasin (2017) investigated the effectiveness of an intervention to reduce non-injection drug and alcohol use for people living with HIV. The extent to which theoretical underpinnings informed the development of personalised feedback interventions might explain the diversity in intervention targets, messages, and effectiveness.

Theoretical Underpinnings

The normative feedback component of electronic personalised normative feedback interventions is designed to promote change in behaviour and/or attitudes by correcting misperceptions commonly held by heavier consumers of alcohol (Dempsey et al., 2018; McAlaney et al., 2011) consistent with the

social norms approach proposed by Perkins and Berkowitz (1986). The greater the misperception between an individual's own behaviour/attitude and the perceived behaviour/attitude of others the more likely the individual is to engage in that behaviour or conform to that perceived attitude (e.g., Neighbors, Dillard, Lewis, Bergstrom, & Neil, 2006). There is extensive evidence that these misperceptions exist for alcohol use and across other health-related behaviours (for a brief review see Dempsey et al., 2018). Electronic personalised feedback aims to challenge these misperceptions, and the implicit social pressure to engage in heavier alcohol use, by highlighting the discrepancy between individual's perceptions and the actual reported norms for that behaviour amongst a relevant social group through personalised feedback (e.g. other student peers at the same university, other employees in your organisation). Reducing this misperception gap, or 'self-other' discrepancy, is considered to be the mechanism underlying many social norms-focused electronic personalised normative feedback interventions (Dempsey et al., 2018). The normative comparison in electronic personalised normative feedback is theorised to motivate heavy drinkers to re-evaluate their use of alcohol and thereby alter their behaviour (Agostinelli & Miller, 1994). Evidences of intervention effects being mediated by changes in perceptions of peer drinking (e.g. Dempsey et al., 2018; Doumas et al., 2010) lend support to this theoretical explanation of how electronic personalised normative feedback interventions work.

It should, however, be noted that many electronic brief alcohol interventions are not explicitly based on an established theoretical model in terms of their development or evaluation, and many provide limited information about their underlying theoretical basis (Miller, Meier, Lombardi, & Leffingwell, 2015; Tebb et al., 2016). Having a clear underpinning theory to electronic personalised normative feedback interventions is important as it accommodates an understanding of what works in an intervention and why (Tebb et al., 2016), facilitates efforts to replicate intervention findings, and also allows for further theory refinement, although many published electronic personalised normative feedback interventions do not attempt the latter (Garnett et al., 2018).

Effectiveness of Electronic Brief Alcohol Interventions with Personalised Feedback

The effectiveness of electronic personalised normative feedback for alcohol use appears to vary according to the specific alcohol use behaviours and

setting under scrutiny. By far the most widely studied group in relation to the effectiveness of electronic personalised normative feedback for alcohol use are college or university students, who represent a clearly identifiable social group, who often report excessive alcohol consumption (Davoren, Demant, Shiely, & Perry, 2016), and who can be easily targeted for intervention. There is a growing evidence base for the effectiveness of electronic brief alcohol interventions that include personalised feedback and electronic personalised feedback interventions for modifying student drinking behaviour (Prosser et al., 2018). There are studies that show that interventions are not always successful, however, including a recent paper by Davies, Lonsdale, Hennelly, Winstock, and Foxcroft (2017) that reported no effect of receiving a digital intervention containing personalised feedback on risky drinking in a sample of university students. Hence, there is a need to advance our understanding of how best to target and to tailor these interventions because relatively little is known about what works best and for whom. It may be that, for university students, some interventions are more effective when delivered early on in their university careers (i.e. during freshman/first and sophomore/second years; Strohman et al., 2016). It is known that alcohol consumption varies over university careers, with data from Bewick, Mulhern, et al. (2008) showing that consumption decreases from first year to second year and then further in the final year, while data from Ferrer, Dillard, and Klein (2012) showed that freshmen students' drank more in the first semester than the second semester and followed a similar pattern in their sophomore year. Research to identify patterns of consumption among university students at different points of their academic careers can be used to inform the delivery of interventions (see Chap. 21 for more on this issue).

Multiple studies also suggest that electronic brief alcohol interventions including personalised feedback may be more effective for students who are high-risk drinkers (e.g. Doumas, Esp, Flay, & Bond, 2017). Text message-based electronic personalised normative feedback interventions have also been found to be effective in college student populations. Students who received personalised feedback and interactive text messaging reported significantly greater reductions in likelihood of driving after drinking and a reduction in the number of drinks consumed before driving (Teeters, Soltis, & Murphy, 2018).

Outside university and college campuses, outcomes for workplace-focused electronic personalised normative feedback interventions focused on employee alcohol use have been more mixed. Some studies suggest promising outcomes if recruitment and retention of users can be achieved (e.g. Brendryen, Johansen, Duckert, & Nevsvag, 2017; Pemberton et al., 2011). Other

evidence suggests low-intensity electronic personalised feedback interventions are not effective in occupational settings (e.g. Khadjesari, Freemantle, Linke, Hunter, & Murray, 2015). While studies support the feasibility and safety of delivering electronic personalised feedback interventions in an occupational setting, one of the main barriers to successful implementation remains recruitment and retention of users (Brendryen et al., 2017). The relatively low number of trials in occupational settings, combined with the heterogeneity of workplaces and interventions, makes it difficult to draw firm conclusions on the likely effectiveness of electronic personalised feedback interventions in workplace settings.

Results from electronic personalised normative feedback interventions delivered in healthcare settings are also mixed; Johnson et al. (2018) reported no significant effect of an electronic personalised normative feedback intervention delivered to hospital outpatients with hazardous and harmful levels of drinking. Qualitative interviews suggested that participants did not believe their drinking was problematic and expressed a preference for face-to-face treatment by a general practitioner rather than electronic interventions (Johnson et al., 2018). Text message delivered electronic feedback that aimed to increase awareness of drinking intentions and promote goal-setting and goal attainment in order to reduce harmful alcohol use was effective in young adults attending US emergency departments (Suffoletto et al., 2012). The positive intervention effects remained at a nine-month follow-up. The authors concluded that the SMS interactive dialogue intervention was more effective, and importantly more acceptable for this population, than the traditional emergency department setting phone call 'boosters' (e.g. Donovan et al., 2015). This provides an illustration of where electronic personalised feedback interventions could provide an effective alternative to more resource-intensive human-delivered low-level interventions.

Comparatively fewer studies have tested the use of electronic personalised normative feedback interventions at the general population level despite their potential to reach large numbers of the population. One study attempted to recruit participants via an email advertising campaign, with those who were identified as drinking at hazardous levels invited to enrol in a study that included an evaluation of an electronic brief alcohol intervention which incorporated personalised feedback (Guillemont et al., 2017). The study struggled to retain participants, with almost 70% of those allocated to the intervention arm of the study lost to follow-up before completion of baseline. Of those that completed the study, there was evidence that the electronic brief alcohol intervention had a positive impact on weekly alcohol intake and

excessive drinking. While promising, these results should be treated with caution due to the high rate of loss to follow-up.

Electronic personalised normative feedback interventions can be targeted towards and personalised for users based on existing alcohol consumption patterns, event-specific drinking behaviours, and/or specific social groups or individuals living or working in a particular geographical location. There is evidence to suggest that electronic personalised normative feedback interventions can be effective in improving alcohol-related outcomes amongst heavier consumers of alcohol, such as heavy drinking first-year intercollegiate athletes (e.g. Doumas et al., 2010) and nightclub patrons classified as high risk (Sanchez & Sanudo, 2018). Targeting electronic personalised normative feedback interventions to those about to encounter a high-risk situation for harmful alcohol use (e.g. a 21st birthday party) can also be an effective strategy (Bernstein et al., 2018), especially for those at higher risk for harmful alcohol consumption.

Given electronic brief alcohol interventions and electronic personalised feedback interventions are often disseminated population-wide (e.g. to all students at a university, to all nightclub patrons), concerns have been raised for the potential for such interventions to have a negative effect on those abstaining from alcohol or drinking at relatively low levels: the so-called boomerang effect (Schultz, Nolan, Cialdini, Goldstein, & Griskevicius, 2007). Worthy of particular scrutiny are personalised normative feedback interventions that could alert participants to their drinking below 'the norm' leading to increases in consumption. A USA study, designed specifically to investigate the existence of the boomerang effect, found no such effect thereby suggesting that personalised normative feedback is not harmful for lighter drinkers (Prince, Reid, Carey, & Neighbors, 2014). Rather, it appears that electronic personalised normative feedback for lighter drinkers and abstainers from alcohol use may have a protective effect against increases in future alcohol use (e.g. Larimer et al., 2007).

While there is growing evidence of the effectiveness of electronic brief alcohol interventions that include personalised feedback for reducing alcohol behaviours, it is not clear if targeting multiple behaviours at once undermines or not the effectiveness of electronic brief alcohol interventions that include personalised feedback/electronic personalised feedback interventions. While some studies report significant improvements in alcohol intake (e.g. Aharonovich et al., 2017; Parekh et al., 2014) others found no significant improvement (e.g. Kypri & McAnally, 2005).

Challenges Associated with Electronic Brief Alcohol Interventions

Whilst there has been a rapid growth in the use of and sophistication of electronic personalised feedback interventions which aim to improve alcohol use outcomes, there remain a number of challenges for the field to address. Despite the growing evidence base for electronic brief alcohol interventions that include personalised feedback and electronic personalised feedback interventions, there remains a relative paucity of information on what motivates individuals to engage with these online programmes under voluntary conditions (Ganz et al., 2018). Studies in the general population often struggle to recruit, retain, and engage participants (e.g. Bertholet et al., 2019; Guillemont et al., 2017), and similar issues with participant attrition have been noted amongst university student samples (Foxcroft, Moreira, Almeida Santimano, & Smith, 2015). If we are to realise the potential for electronic personalised feedback interventions to contribute to reducing the global burden of alcohol misuse we must advance our understanding of how to successfully engage individuals with such interventions.

Studies evaluating the effectiveness of electronic personalised feedback interventions typically focus on the immediate or short-term effects of feedback on alcohol use, with few investigating the longer-term effects of electronic personalised feedback interventions (e.g. Neighbors et al., 2010). Given the typically brief and time-limited nature of personalised normative feedback, it may be additional top-up or booster administrations of brief feedback that are required to maintain positive changes in alcohol use over the medium-to-longer term.

By necessity, many personalised feedback interventions include self-report assessments and self-monitoring components. There remain concerns around the use of self-report data when evaluating the effectiveness of alcohol interventions in general, and those that include personalised feedback and electronic personalised normative feedback (e.g. Dempsey et al., 2018). The field would benefit from the development of objective measures of alcohol use that are widely available, cost-effective, and can be easily integrated into electronic personalised normative feedback interventions. It is likely that self-assessment/self-monitoring is an active ingredient of some personalised feedback interventions (e.g. Bewick et al., 2013; Marley, Bekker, & Bewick, 2016), although the finding of significant reactivity to assessment is not consistent across all trials (e.g. Suffoletto et al., 2015). It may be that where assessment leads to successful self-monitoring, the effect of electronic brief alcohol interventions/

electronic personalised normative feedback interventions is being underestimated. The field would benefit from the inclusion of four-group trial designs, which feature intervention and control groups which receive, or do not receive, baseline assessments (Solomon, 1949), allowing for the potential effects of baseline assessments on behaviour change to be accounted for.

Concerns have also been raised of the potential for personalised feedback to result in a self-report bias due to social desirability. This self-report bias could, it is argued, account partially/solely for the reported reductions in drinking/drinking-related behaviour associated with interventions that include personalised feedback (Cunningham & Wong, 2013).

Future Directions for Research

The development of web-based technologies has enabled the delivery of more personalised feedback interventions for alcohol use, and the increasing sophistication of mobile technologies provides opportunities to extend complexity and reach. Devices, such as smartphones, that are used to deliver electronic brief alcohol interventions have grown increasingly powerful and are able to record a wide range of user data. This data includes not only the direct usage of the device but also other information such as the physical movement of the individual and their geographic location. With regard to alcohol use, for example, it could be possible to use smartphone data to determine how often an individual visits bars, and if so which friends or work colleagues they are most likely to do so with. This type of data collection can occur in the background and requires no effort by the individual, other than providing the initial permissions for this data to be shared with researchers or health experts. This has the potential for opening up new areas of personalised feedback. For example, a system could be created to message an individual when they have spent a certain amount of time in a bar. By working with the individual this message could be personalised to a goal that they set themselves—for instance, a request that they be sent an intervention message suggesting they may wish to go home if the system detects that they have been in a bar for more than two hours. Taken further, such systems could link to other information available through the individual's smartphone. For example, any financial transaction relating to the purchase of alcohol by use of a credit or debit card could be blocked once the individual has spent a predetermined amount of money on alcohol on a night out. Such an approach is already being trialled in relation to problem gambling (Monzo, 2018).

Personalised feedback can also be delivered using systems that not only react to individual behaviour but also predict future states of behaviour through the use of machine learning and artificial intelligence. This approach has been used to predict future suicide attempts with a relatively high degree of accuracy (Walsh, Ribeiro, & Franklin, 2017). For alcohol use e-interventions, the application of machine learning and artifical intelligences may be able to detect when there is about to be an escalation in alcohol consumption, or when an individual may be about to place themselves in a dangerous situation as a result of drunkenness and send personalised feedback to the individual. More routinely, the system could learn the alcohol consumption practices of the individual and identify exactly when to send personalised feedback messages that are the most likely to have a beneficial impact. A system such as this could operate 24 hours a day and take action in the absence of any human operator, although this is not to say that such systems should be left completely unsupervised by human experts.

Conclusion

Electronic personalised feedback interventions are under-utilised in general population samples despite evidence they are effective when delivered to college or university student samples. Web-based personalised feedback interventions have facilitated greater personalisation of feedback towards specific target groups—often based on personalised normative feedback. Research is needed to develop the theory base for these interventions, thus making it difficult to identify active ingredients and effective treatment mechanisms. Advances in mobile technology and the internet-of-things hold promise for the development of more sophisticated interventions and the collection of alcohol-related behaviours in addition to self-report measures. Realising the potential for new technologies to increase the effectiveness and successful implementation of personalised feedback will allow us to intervene early and thereby contribute to a reduction in the global burden of alcohol-related harms and improve the lives of those affected.

References

Acuff, S. F., Voss, A. T., Dennhardt, A. A., Borsari, B., Martens, M. P., & Murphy, J. G. (2019). Brief motivational interventions are associated with reductions in alcohol-induced blackouts among heavy drinking college students. *Alcoholism: Clinical and Experimental Research, 43*, 988–996.

Agostinelli, G., & Miller, W. R. (1994). Drinking and thinking: How does personal drinking affect judgments of prevalence and risk. *Journal of Studies on Alcohol, 55*, 327–337.

Aharonovich, E., Stohl, M., Cannizzaro, D., & Hasin, D. (2017). HealthCall delivered via smartphone to reduce co-occurring drug and alcohol use in HIV-infected adults: A randomized pilot trial. *Journal of Substance Abuse Treatment, 83*, 15–26.

Angus, C., Latimer, N., Preston, L., Li, J., & Purshouse, R. (2014). What are the implications for policy makers? A systematic review of the cost-effectiveness of screening and brief interventions for alcohol misuse in primary care. *Frontiers in Psychiatry, 5*, 114.

Bedendo, A., Ferri, C. P., de Souza, A. A. L., Andrade, A. L. M., & Noto, A. R. (2019). Pragmatic randomized controlled trial of a web-based intervention for alcohol use among Brazilian college students: Motivation as a moderating effect. *Drug and Alcohol Dependence, 199*, 92–100.

Bendtsen, P., Bendtsen, M., Karlsson, N., White, I. R., & McCambridge, J. (2015). Online alcohol assessment and feedback for hazardous and harmful drinkers: Findings from the AMADEUS-2 randomised controlled trial of routine practice in Swedish universities. *Journal of Medical Internet Research, 17*(7), e170.

Bernstein, M. H., Stein, L. A. R., Neighbors, C., Suffoletto, B., Carey, K. B., Ferszt, G., … Wood, M. D. (2018). A text message intervention to reduce 21st birthday alcohol consumption: Evaluation of a two-group randomized controlled trial. *Psychology of Addictive Behaviors, 32*(2), 149–161.

Bertholet, N., Godinho, A., & Cunningham, J. A. (2019). Smartphone application for unhealthy alcohol use: Pilot randomized controlled trial in the general population. *Drug and Alcohol Dependence, 195*, 101–105.

Bewick, B. M., Mulhern, B., Barkham, M., Trusler, K., Hill, A. J., & Stiles, W. B. (2008). Changes in undergraduate student alcohol consumption as they progress through university. *BMC Public Health, 8*, 163–170.

Bewick, B. M., Trusler, K., Mulhern, B., Barkham, M., & Hill, A. J. (2008). The feasibility and effectiveness of a web-based personalised feedback and social norms alcohol intervention in UK university students: A randomised control trial. *Addictive Behaviors, 33*(9), 1192–1198.

Bewick, B. M., West, R. M., Barkham, M., Mulhern, B., Marlow, R., Traviss, G., & Hill, A. J. (2013). The effectiveness of a web-based personalised feedback and social norms alcohol intervention on United Kingdom university students: Randomized controlled trial. *Journal of Medical Internet Research, 15*(7), e137.

Bewick, B. M., West, R. M., Gill, J., O'May, F., Mulhern, B., Barkham, M., & Hill, A. J. (2010). Providing web-based feedback and social norms information to reduce student alcohol intake: A multisite investigation. *Journal of Medical Internet Research, 12*(5), e59.

Borsari, B., & Carey, K. B. (2000). Effects of a brief motivational intervention with college student drinkers. *Journal of Consulting and Clinical Psychology, 68*(4), 728–733.

Brendryen, H., Johansen, A., Duckert, F., & Nevsvag, S. (2017). A pilot randomised controlled trial of an internet-based alcohol intervention in a workplace setting. *International Journal of Behavioral Medicine, 24*(5), 768–777.

Buckner, J. D., Neighbors, C., Walukevich-Dienst, K., & Young, C. M. (2019). Online personalized normative feedback intervention to reduce event-specific drinking during Mardi Gras. *Experimental and Clinical Psychopharmacology*. https://doi.org/10.1037/pha0000259

Carey, K. B., Carey, M. P., Maisto, S. A., & Henson, J. M. (2006). Brief motivational interventions for heavy college drinkers: A randomized controlled trial. *Journal of Consulting and Clinical Psychology, 74*(5), 943–954. https://doi.org/10.1037/0022-006X.74.5.943

Carey, K. B., Carey, M. P., Maisto, S. A., & Henson, J. M. (2009). Computer versus in-person intervention for students violating campus alcohol policy. *Journal of Consulting and Clinical Psychology, 77*(1), 74–87.

Carey, K. B., Scott-Sheldon, L. A., Carey, M. P., & DeMartini, K. S. (2007). Individual-level interventions to reduce college student drinking: A meta-analysis review. *Addictive Behaviors, 32*(11), 2469–2494.

Crane, D., Garnett, C., Michie, S., West, R., & Brown, J. (2018). A smartphone app to reduce excessive alcohol consumption: Identifying the effectiveness of intervention components in a factorial randomised control trial. *Scientific Reports, 8*(1), 4384.

Cunningham, J. A., Khadjesari, Z., Bewick, B. M., & Riper, H. (2010). Internet-based interventions for problem drinkers: From efficacy trials to implementation. *Drug and Alcohol Review, 29*(6), 617–622.

Cunningham, J. A., Shorter, G. W., Murphy, M., Kushnir, V., Rehm, J., & Hendershot, C. S. (2017). Randomized controlled trial of a brief versus extended internet intervention for problem drinkers. *International Journal of Behavioural Medicine, 24*(5), 760–767.

Cunningham, J. A., & Wong, H. T. A. (2013). Assessing the immediate impact of normative drinking information using an immediate post-test randomized controlled design: Implications for normative feedback interventions. *Addictive Behaviors, 38*, 2252–2256.

Daeppen, J. B., Bertholet, N., Gaume, J., Fortini, C., Faouzi, M., & Gmel, G. (2011). Efficacy of brief motivational intervention in reducing binge drinking in young men: A randomized controlled trial. *Drug and Alcohol Dependence, 13*, 69–75.

Davies, E. L., Lonsdale, A. J., Hennelly, S. E., Winstock, A. R., & Foxcroft, D. R. (2017). Personalized digital interventions showed no impact on risky drink-

ing in Young adults: A pilot randomized controlled trial. *Alcohol and Alcoholism*, 1-6. https://doi.org/10.1093/alcalc/agx051

Davoren, M. P., Demant, J., Shiely, F., & Perry, I. J. (2016). Alcohol consumption among university students in Ireland and the United Kingdom from 2002 to 2014: A systematic review. *BMC Public Health, 16*(1), 173.

Deloitte. (2018). *Global mobile consumer survey: US edition*. Available from: https://www2.deloitte.com/content/dam/Deloitte/us/Documents/technology-media-telecommunications/us-tmt-global-mobile-consumer-survey-exec-summary-2018.pdf. Accessed 16 July 2019.

Dempsey, R. C., McAlaney, J., & Bewick, B. M. (2018). A critical appraisal of the social norms approach as an interventional strategy for health-related behaviour and attitude change. *Frontiers in Psychology, 9*, 2180.

Donovan, D. M., Hatch-Maillette, M. A., Phares, M. S. W., McGarry, E., Peavey, K. M., & Taborsky, J. (2015). Lessons learned from follow-up phone booster counselling calls with substance abusing emergency department patients. *Journal of Substance Abuse Treatment, 50*, 67–75. https://doi.org/10.1016/j.jsat.2014.10.013.

Doumas, D., Esp, S., Flay, B., & Bond, L. (2017). A randomized controlled trial testing the efficacy of a brief online alcohol intervention for high school seniors. *Journal of Studies on Alcohol and Drugs, 78*(5), 706–715.

Doumas, D. M., & Andersen, L. L. (2009). Reducing alcohol use in first-year university students: Evaluation of a web-based personalized feedback program. *Journal of College Counselling, 12*, 18–32.

Doumas, D. M., & Hannah, E. (2008). Preventing high-risk drinking in youth in the workplace: A web-based normative feedback program. *Journal of Substance Abuse Treatment, 34*(3), 263–271.

Doumas, D. M., Haustveit, T., & Coll, K. M. (2010). Reducing heavy drinking among first year intercollegiate athletes: A randomised controlled trial of web-based normative feedback. *Journal of Applied Sport Psychology, 22*(3), 247–261.

Dunn, M. E., Fried-Somerstein, A., Flori, J. N., Hall, T. V., & Dvorak, R. D. (2019). Reducing alcohol use in mandated college students: A comparison of a brief motivational intervention (BMI) and the expectancy challenge alcohol literacy curriculum (ECALC). *Experimental and Clinical Psychopharmacology*. https://doi.org/10.1037/pha0000290

Ferrer, R. A., Dillard, A. J., & Klein, W. M. P. (2012). Projection, conformity, and deviance regulation: A prospective study of alcohol use. *Psychology and Health, 27*(6), 688–703.

Festinger, L. (1954). A theory of social comparison processes. *Human Communications, 7*, 117–140.

Foxcroft, D. R., Moreira, M. T., Almeida Santimano, N. M. L., & Smith, L. A. (2015). Social norms information for alcohol misuse in university and college students. *The Cochrane Database of Systematic Reviews, 1*, CD006748. https://doi.org/10.1002/14651858.CD006748.pub3

Ganz, T., Braun, M., Laging, M., Schermelleh-Engel, K., Michalak, J., & Heidenreich, T. (2018). Effects of a stand-alone web-based electronic screening and brief intervention targeting alcohol use in university students of legal drinking age: A randomized controlled trial. *Addictive Behaviours, 77*, 81–88.

Garnett, C., Crane, D., Brown, J., Kaner, E., Beyer, F., Muirhead, C., … Michie, S. (2018). Reported theory use by digital interventions for hazardous and harmful alcohol consumption, and association with effectiveness: Meta-regression. *Journal of Medical Internet Research, 20*(2), e69.

Guillemont, J., Cogordan, C., Nalpas, B., Nguyen-Thanh, V., Richard, J.-B., & Arwidson, P. (2017). Effectiveness of a web-based intervention to reduce alcohol consumption among French hazardous drinkers: A randomized controlled trial. *Health Education Research, 32*(4), 332–342.

Ingersoll, K., Frederick, C., MacDonnell, K., Ritterband, L., Lord, H., Jones, B., & Truwit, B. S. (2018). A pilot RCT on an internet intervention to reduce the risk of alcohol-exposed pregnancy. *Alcohol Clinical Experimental Research, 42*(6), 1132–1144.

Johnson, N. A., Kypri, K., Latter, J., Dunlop, A., Brown, A., Saitz, R., … McCambridge, J. (2018). Effect of electronic brief intervention on uptake of speciality treatment in hospital outpatients with likely alcohol dependence: Pilot randomized trial and qualitative interviews. *Drug and Alcohol Dependence, 183*, 253–260.

Johnson, N. A., Kypri, K., Saunders, J. B., Saitz, R., Attia, J., Latter, J. L., … McCambridge, J. (2018). Effect of electronic screening and brief intervention on hazardous or harmful drinking among adults in the hospital outpatient setting: A randomized, double-blind, controlled trial. *Drug and Alcohol Dependence, 191*, 78–85.

Kaner, E., Dickinson, H., Beyer, F., Muirhead, C., Campbell, F., Pienaar, E. D., … Burnard, B. (2009). The effectiveness of brief alcohol interventions in primary care settings: A comprehensive review. *Drug Alcohol Review, 28*, 301–323.

Kaner, E. F. S., & Bewick, B. M. (2011). Brief alcohol intervention in young people. In J. B. Saunders & J. M. Rey (Eds.), *Young people and alcohol: Impact, policy, prevention, treatment* (pp. 153–169). West Sussex, UK: Blackwell Publishing.

Kenney, S. R., Napper, L. E., LaBrie, J. W., & Martens, M. P. (2014). Examining the efficacy of a brief group protective behavioral strategies skills training alcohol intervention with college women. *Psychology of Addictive Behaviors, 28*(4), 1041–1051.

Khadjesari, Z., Freemantle, N., Linke, S., Hunter, R., & Murray, E. (2015). Correction: Health on the web: Randomised controlled trial of online screening and brief alcohol intervention delivered in a workplace setting. *PLoS One, 10*(4), e0127371.

Kypri, K., & McAnally, H. M. (2005). Randomized controlled trial of a web-based primary care intervention for multiple health risk behaviors. *Preventive Medicine, 41*(3–4), 761–176.

Kypri, K., Saunders, J. B., & Gallagher, S. (2003). Acceptability of various brief intervention approaches for hazardous drinking among university students. *Alcohol and Alcoholism, 38*(6), 626–628.

LaBrie, J. W., Lewis, M. A., Atkins, D. C., Neighbors, C., Zheng, C., Kenney, S. R., … Larimer, M. E. (2013). RCT of web-based personalized normative feedback for college drinking prevention: Are typical student norms good enough? *Journal of Consulting and Clinical Psychology, 81*, 1074–1086.

Larimer, M. E., Lee, C. M., Kilmer, J. R., Fabiano, P. M., Stark, C. B., Geisner, I. M., et al. (2007). Personalized mailed feedback for college drinking prevention: A randomized clinical trial. *Journal of Consulting and Clinical Psychology, 75*, 285–293.

Liu, S., Wu, S., Chen, S., Huang, H., Sun, F., Fang, C., … Shih, S. (2011). Randomized controlled trial of a brief intervention for unhealthy alcohol use in hospitalized Taiwanese men. *Addiction, 106*, 928–940. https://doi.org/10.1111/j.1360-0443.2010.03330.x

Manthey, J., Shield, K. D., Rylett, M., Hasan, O. S. M., Probst, C., & Rehm, J. (2019). Global alcohol exposure between 1990 and 2017 and forecasts until 2030: A modelling study. *The Lancet, 393*(10190), 2493–2502.

Marley, S., Bekker, H. L., & Bewick, B. M. (2016). Responding to personalised social norms feedback from a web-based alcohol reduction intervention for students: Analysis of think-aloud verbal protocols. *Psychology & Health, 31*(9), 1007–1024.

Marques, A. C., & Formigoni, M. L. (2001). Comparison of individual and group cognitive-behavioral therapy for alcohol and/or drug-dependent patients. *Addiction, 96*, 835–846.

McAlaney, J., Bewick, B., & Hughes, C. (2011). The international development of the 'social norms' approach to drug education and prevention. *Drugs: Education, Prevention, and Policy, 18*(2), 81–89.

Miller, M. B., DiBellow, A. M., Carey, K. B., & Pederson, E. R. (2018). Blackouts as a moderator of young adult veteran response to personalized normative feedback for heavy drinking. *Alcoholism: Clinical and Experimental Research, 42*(6), 1145–1153.

Miller, M. B., Meier, E., Lombardi, N., & Leffingwell, T. R. (2015). Theories of behaviour change and personalised feedback interventions for college student drinking. *Addiction Research and Theory, 23*(4), 322–335.

Monzo. (2018). *Supporting people to self-exclude from gambling*. Available from: https://monzo.com/blog/2018/05/16/gambling-self-exclusion. Accessed 16 July 2019.

National Institute for Health and Care Excellence (NICE). (2014). *Behaviour change: Individual approaches (Public Health Guideline PH49)*. Available from: http://www.nice.org.uk/guidance/ph49/chapter/about-this-guidance. Accessed 28 July 2019.

National Institute on Alcohol Abuse and Alcoholism (NIAAA). (2015). *College AIM: Alcohol intervention matrix*. Available from: https://www.collegedrinkingprevention.gov/CollegeAIM/Default.aspx. Accessed 16 July 2019.

Neighbors, C., DiBello, A. M., Young, C. M., Steers, M.-L. N., Rinker, D. V., Rodriguez, L. M., … Lewis, M. A. (2019). Personalized normative feedback for heavy drinking: An application of deviance regulation theory. *Behaviour Research and Therapy, 115*, 73–82.

Neighbors, C., Dillard, A. J., Lewis, M. A., Bergstrom, R. L., & Neil, T. A. (2006). Normative misperceptions and temporal precedence of perceived norms and drinking. *Journal of Studies on Alcohol, 67*, 290–299.

Neighbors, C., Lewis, M. A., Atkins, D. C., Jensen, M. M., Walter, T., Fossos, N., … Larimer, M. E. (2010). Efficacy of web-based personalized normative feedback: A two-year randomized controlled trial. *Journal of Consulting and Clinical Psychology, 78*(6), 898–911.

Neighbors, C., Rodriguez, L. M., Rinker, D. V., Gonzales, R. G., Agana, M., Tackett, J. L., & Foster, D. W. (2015). Efficacy of personalized normative feedback as a brief intervention for college student gambling: A randomized controlled trial. *Journal of Consulting and Clinical Psychology, 83*(3), 500–511.

Parekh, S., King, D., Boyle, F. M., & Vandelanotte. (2014). Randomized controlled trial of a computer-trailed multiple health behaviour intervention in general practice: 12-month follow-up results. *International Journal of Behavioural Nutrition and Physical Activity, 11*, 41.

Pedersen, E. R., Neighbors, C., Atkins, D. C., Lee, C. M., & Larimer, M. E. (2017). Brief online interventions targeting risk and protective factors for increased and problematic alcohol use among American college students studying abroad. *Psychology of Addictive Behaviors, 31*(2), 220–230.

Pedersen, E. R., Parast, L., Marshall, G. N., Schell, T. L., & Neighbors, C. (2017). A randomized controlled trial of a web-based personalized normative feedback alcohol intervention for young-adult veterans. *Journal of Consulting and Clinical Psychology, 85*(5), 459–470.

Pemberton, M. R., Williams, J., Herman-Stahl, M., Calvin, S. L., Bradshaw, M. R., Bray, R. M., … Mitchell, G. M. (2011). Evaluation of two web-based alcohol interventions in the U.S. military. *Journal of Studies Alcohol and Drugs, 72*(3), 480–489.

Perkins, H. W., & Berkowitz, A. D. (1986). Perceiving the community norms of alcohol use among students: some research implications for campus alcohol education programming. *International Journal of the Addictions, 21*, 243–256.

Platt, L., Melendez-Torres, G. J., O'Donnell, A., Bradley, J., Newbury-Birch, D., Kaner, E., & Aston, C. (2016). How effective are brief interventions in reducing alcohol consumption: Do the setting, practitioner group and content matter? Findings from a systematic review and meta regression analysis. *BMJ Open, 6*, e011473. https://doi.org/10.1136/bmjopen-2016-011473

Prince, M. A., Reid, A., Carey, K. B., & Neighbors, C. (2014). Effects of normative feedback for drinkers who consume less than the norm: Dodging the boomerang. *Psychology of Addictive Behaviours, 28*(2), 538–544.

Prosser, T., Gee, K. A., & Jone, F. (2018). A meta-analysis of effectiveness of e-interventions to reduce alcohol consumption in college and university students. *Journal of American College Health, 66*(4), 292–301.

Ridout, B., & Campbell, A. (2014). Using Facebook to deliver a social norm intervention to reduce problem drinking at university. *Drug & Alcohol Review, 33*, 667–673.

Riper, H., Hoogendoorn, A., Cuijper, P., Karyotaki, E., Boumparis, N., Mira, A., … Smit, J. H. (2018). Effectiveness and treatment moderators of internet interventions for adult problem drinking: An individual patient data meta-analysis of 19 randomised controlled trials. *PLoS Medicine, 15*(12), e1002714.

Riper, H., Spek, V., Boon, B., Conijn, B., Kramer, J., Martin-Abello, K., & Smit, F. (2011). Effectiveness of e-self-help interventions for curbing adult problem drinking: A meta-analysis. *Journal of Medical Internet Research, 13*(2), e42.

Sanchez, Z. M., & Sanudo, A. (2018). Web-based alcohol intervention for nightclub patrons: Opposite effects according to baseline alcohol use disorder classification. *Substance Abuse, 39*(3), 361–370.

Schultz, P. W., Nolan, J. M., Cialdini, R. B., Goldstein, N. J., & Griskevicius, V. (2007). The constructive, destructive, and reconstructive power of social norms. *Psychological Science, 18*(5), 429–434.

Sher, K. J., Bartholow, B. D., & Nanda, S. (2001). Short- and long-term effects of fraternity and sorority membership on heavy drinking: A social norms perspective. *Psychology of Addictive Behaviors, 15*(1), 42–51.

Solomon, R. L. (1949). An extension of control group design. *Psychological Bulletin, 46*, 137–150.

Strohman, A. S., Braje, S. E., Alhassoon, O. M., Shuttleworth, S., Van Slyke, J., & Gandy, S. (2016). Randomized controlled trial of computerized alcohol intervention for college students: Role of class level. *American Journal of Drug and Alcohol Abuse, 42*(1), 15–24.

Suffoletto, B., Callaway, C., Kristan, J., Kraemer, K., & Clark, D. B. (2012). Text-message-based drinking assessments and brief interventions for young adults discharged from theemergency department. *Alcohol Clin Exp Res, 36*, 552–560. https://doi.org/10.1111/j.1530-0277.2011.01646.x.

Suffoletto, B., Kristan, J., Chung, T., Jeong, K., Fabio, M., & P., & Clark, D.B. (2015). An interactive text message intervention to reduce binge drinking in young adults: A randomised controlled trial with 9-month outcomes. *PLoS One, 10*(11), e0142877.

Taylor, C. T., Bomyea, J., & Amir, N. (2010). Attentional bias away from positive social information mediates the link between social anxiety and anxiety vulnerability to a social stressor. *Journal of Anxiety Disorders, 24*(4), 403–408.

Tebb, K. P., Erenrich, R. K., Bradner-Jasik, C., Berna, M. S., Lester, J. C., & Ozer, E. M. (2016). Use of theory in computer-based interventions to reduce alcohol use among adolescents and young adults: A systematic review. *BMC Public Health, 16*, 517.

Teeters, J. B., Soltis, K. E., & Murphy, J. G. (2018). A mobile phone-based brief intervention with personalized feedback and text messaging is associated with reductions in driving after drinking among college drinkers. *Journal of Studies on Alcohol and Drugs, 79*(5), 710–719.

Thompson, K., Burgess, J., & MacNevin, P. D. (2018). An evaluation of e-CHECKUPTOGO in Canada: The mediating role of changes in social norm misperceptions. *Substance Use and Misuse, 53*(11), 1849–1858.

Walsh, C. G., Ribeiro, J. D., & Franklin, J. C. (2017). Predicting risk of suicide attempts over time through machine learning. *Clinical Psychological Science, 5*(3), 457–469.

Wechsler, H., Lee, J. E., Kuo, M., Seibring, M., Nelson, T. F., & Lee, H. (2002). Trends in college binge drinking during a period of increased prevention efforts: Findings from 4 Harvard School of Public Health College alcohol study surveys: 1993–2001. *Journal of American College Health, 50*, 203–217.

Wilke, D. J., Mennicke, A., Howell, R. L., & Magnuson, A. B. (2014). A peer-facilitated intervention to reduce risky drinking among fraternity and sorority members. *Journal of Social Work Practice in the Addictions, 14*(1), 42–63.

World Health Organization. (2018). *Global status report on alcohol and health 2018.* Geneva, Switzerland: WHO. Licence: CC BY-NC-SA 3.0 IGO.