



**Runanga Whakapiki Ake i te Hauora o Aotearoa**  
**Health Promotion Forum of New Zealand**

**The Use of Internet and Mobile Phone Based Health  
Promotion Interventions in Youth Populations**

**- Literature Review -**

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# 1 Introduction

Globally, the use of the communication technologies such as mobile phones and internet continues to rise (Hung et al., 2013; PewResearch, 2014). Such technologies are providing new ways to communicate and share information, and continue to develop in ways that are almost unimaginable. As Jorm et al. (2014) state, "...new devices, which until their development we did not realise we needed, will continue to be created" (p.104). In response to greater use and familiarity, health services are increasingly utilising technology to directly communicate with consumers (e.g. appointment reminders, regular medication reminders, and test results) and to deliver information (e.g through websites and social media) (Free et al., 2013; Thorn, 2014). Although a lack of literature on the use of such technologies in health promotion reflects that technology-based approaches are still in their infancy, Gold, Lim, Hellard, Hocking, and Keogh (2010) anticipate that they will soon become common practice. "As the use of newer communication technologies continues to exponentially increase, health promotion will inevitably expand out from the 'old' media (TV, radio, billboards) and into the 'new' (mobile telephones, social networking sites)" (pp.1-2).

To date, technology-based health promotion initiatives appear to be taking advantage of various technologies (e.g. computers, internet, mobile phones, handheld devices (i.e. tablets), CD-Roms, computer kiosks) and the several features they offer (Bull & McFarlane, 2011). Given the advancing capabilities of each of these modalities, exactly how they are used to deliver interventions differs significantly between interventions. However, key advantageous features include reach, standardised information, interactivity, privacy, autonomy, portability, and potentially lower costs (Bull & McFarlane, 2011). While interventions are not without their limitations, a rapidly emerging body of literature lends support to the use of technology-based health promotion interventions to address a wide range of health issues, including those targeting smoking cessation, sexual health, physical activity, weight loss, and alcohol use (De Bourdeaudhuij, Stevens, Vandelanotte, & Brug, 2007; Hurling et al., 2007; Khadjesari et al., 2011; Lightfoot, Comulada, & Stover, 2007; Patrick et al., 2009; Rodgers et al., 2005).

As the use of technology-based health promotion is no doubt a foreign concept to many health promoters, it is helpful to draw on Rickwood (2012) conceptualisation of youth mental health promotion through the components of the Ottawa Charter;

- **Supportive Environments:** Online environments extend the opportunity for social interactions that may not have been available otherwise. With supportive environments offering social support, belonging, and connecting, an online setting opens up support to particular populations, such as those isolated by location and/or disability, or those who may wish to seek support anonymously.
- **Development of Personal Skills:** Young people are able to learn new skills on the internet.
- **Strengthen community action:** internet communication tools (e.g. blogs, chat rooms) enable people to engage with local and social communities on particular issues.
- **Building Healthy Public Policy:** internet communication tools enable youth to influence public policy by expressing their political views on areas that affect their health and wellbeing.
- **Re-orientation of health services:** Re-orienting health services towards health promotion that is delivered through technology-mediated interventions is important as it provides "...health services with ever-expanding ways to promote health, as well as treat illness" (p.22).

Health promotion is particularly pertinent during adolescence. This is because it is important for adolescents to form healthy habits that they can maintain through adulthood, to be aware of symptoms of health issues (e.g. mental illness), and to know how to minimise their risk for preventable health issues (Bailey et al., 2013; Cullen et al., 2013; Rickwood, 2012). Health promotion is also important to help minimise the high social and economic costs that are associated with the many health issues affecting adolescents (Bailey et al., 2013).

The use of technology-based health promotion approaches among youth has been particularly encouraged due to technology's reach and popularity with this age group, and is seen as a 'new channel' for behaviour change (Cullen, Thompson, Boushey, Konzelmann, & Chen, 2013). Research has shown that young people tend to prefer support from informal sources (Collin et al., 2011; Gould, Munfakh, & Lubell, 2002). They are therefore likely to be open to technology-based approaches. Technology-based approaches enable youth to seek help anonymously and autonomously, which may be particularly advantageous to young people when seeking help for sensitive health topics or stigmatised behaviours (e.g. alcohol consumption) (Khadjesari, Murray, Hewitt, Hartley, & Godfrey, 2011), and/or those who prefer self-help (especially males) (Ellis et al., 2013).

In an attempt to work towards the re-orientation of health services towards including technology-based health promotion, this review will demonstrate how health promotion is embracing technology to deliver interventions. A particular focus will be placed on internet- and mobile phone-based interventions with youth populations, who appear to be embracing such intervention mediums with ease and enjoyment. To help exemplify how technology-based interventions are delivered, this review will include selected case studies on health issues that particularly pertinent during adolescence, including diet and physical activity, mental health, alcohol consumption, smoking cessation, and sexual health. It is hoped that an understanding of the many intervention facets (e.g. recruitment, delivery mode, and duration) will be of use to anyone wishing to implement a technology-based health promotion intervention.

## 2 Internet-based Health Promotion

Internet use is increasing rapidly. Since 2000, there has been a 676.3 percent increase in the number of users, with 2.8 billion web users worldwide at the end of 2013 (Statistics, 2014). One US study found that, in 2009, young people (8-18 years) spent an average of 7.5 hours online each day (Rideout, Foehr, & Roberts, 2010). While such evidence alone demonstrates the internet's popularity among youth, it is likely that its use has increased substantially over the past few years as social networking sites have become more popular, and schools increasingly require students to bring internet-enabled devices to class (Harris, 2012).

Literature identifies several key features of the internet that demonstrate its suitability as a medium for delivering health promotion interventions. First, web-based health promotion approaches are relatively cheap to produce, yet are also able to reach a large number of people from a targeted population quickly and efficiently (Bailey et al., 2013; Bull & McFarlane, 2011; Cullen et al., 2013). Websites can also be edited easily, making it a quick and straightforward process to update information and displays as necessary (Bull & McFarlane, 2011). Research evaluating the effectiveness of internet-based interventions has identified key features of the internet that are of particular use to research, including automated randomisation, blind allocation to study conditions, and easy data collection (Bailey et al., 2013; Bull & McFarlane, 2011; Tait & Christensen, 2010). For users, key advantageous features of internet-based approaches are that they are convenient and readily available, that they are delivered through a medium that users are likely to be familiar with, and the interactivity that websites offer allow users to take an active part in activities that promote healthy choices (Bailey et al., 2013; Cullen et al., 2013). Web-based health promotion interventions also offer autonomy and anonymity for help around topics that may be sensitive and/or stigmatised, such as sexual health (Bailey et al., 2013). As the following demonstrates, internet-based health promotion approaches use a wide range of delivery modes, including self-guided websites, interactive websites, online games, and social media.

### 2.1 Self-Guided Websites

Increasingly, consumers are using the internet as a tool for self-education on health related topics (Hung et al., 2013). While the number of websites detailing preventative health practices appears to be scant in comparison to the many detailing the symptoms and treatment of common health issues, there are a number of trustworthy health promotion sites that are run by large organisations and government agencies. Examples include The Heart Foundation, Life Hack, The Low Down and All Right? Such websites are likely to work towards the 'Development of Personal Skills', however a lack of published literature means that their effect on behaviour change is unknown. The following case study on an Australian youth mental health promotion website does, however, help to demonstrate how self-guided websites may be received by users, and their potential for resulting in behaviour change.

#### 2.1.1 Case Study: ReachOut.com

ReachOut.com is an Australian website that aims to provide young people (14-25 years old) with information on mental health and wellbeing, in addition to supportive tools, skills, and connections to assist people with significant mental health issues to access support (Collin et al., 2011). The website utilises numerous internet features to deliver a range of components, including providing research-supported information and fact sheets, an online forum and blog, an online game, digital stories and videos, and use of social media. The website's peer-based and

user-led nature; whereby users can interact online; enables users to offer support to one another by sharing their own experiences and encouraging them to seek help (Collin et al., 2011).

Evidence suggests the site is very popular (average of 96,508 views per month), and is well received by the website's targeted youth population. Findings from a cross-section user profiling survey with 1552 respondents aged between 14 and 25 years of age (76% female found that respondents felt that they "have more understanding about mental health issues" (84%), and that they have "learnt more about other people's experience of a mental health issue" (Collin et al., 2011). 74.3 percent of survey respondents also saw the site as 'trustworthy', and 66 percent of respondents indicated that they would recommend the site to a friend who was going through a tough time.

Help-seeking, which Rickwood, Deane, and Wilson (2007) describe as particularly important in reducing the long-term impact of mental health difficulties, also appeared to be supported by the website; with 60.4 percent of survey respondents indicating that they visited the website when they were going through a tough time. 43.3 percent of respondents indicated that the website had helped them 'quite a bit' or 'a lot' to learn skills, knowledge and confidence to seek help if they needed it, while 35.2 percent of survey respondents said that the ReachOut website had helped them ask for professional help 'quite a bit' or 'a lot'.

Notably, although 71.2 percent of respondents scored in the two highest psychological distress categories on the K-10 measure (Kessler et al., 2002), just 53 percent of these respondents indicated that they visited the site because they were looking for help. This finding illustrates the importance of providing mental health promotion websites to help young people recognise the symptoms of mental illness and to know where they can get support. Further supporting the provision of such websites is the study's finding that young people have a strong preference for seeking help from informal sources (including friends, family, and the internet) than face-to-face sources (e.g. professionals). Finally, while effects on behaviour change cannot be drawn from this research, the authors suggest that there may be a 'dose-relationship', whereby the more times an individual accesses a site, the better its effectiveness in improving mental health literacy and help-seeking (Collin et al., 2011).

## 2.2 Website based programmes

Like self-directed websites, web-based interventions that are tailored to individuals are also plentiful. They have been evaluated as successful in improving a wide range of healthy behaviours, including diet, weight-loss, sexual health promotion, and alcohol consumption, to name a few (Bailey et al., 2013; De Bourdeaudhuij et al., 2007; Tait & Christensen, 2010). Typically, such websites require participants to log on weekly, to set goals, complete activities, and to monitor their own progress. The following case studies demonstrate two distinct approaches to delivering web-based interventions;

### 2.2.1 Case Study: Teen Choice: Food and Fitness

Teen Choice: Food and Fitness is a web-based programme designed by adolescents that aims to encourage healthy eating and physical activity (Cullen et al., 2013; Thompson, Cullen, Boushey, & Konzelmann, 2012). Drawing on the Social Cognitive Theory (SCT) (Bandura, 1986), the website includes role model stories (stories by adolescent characters addressing barriers to healthy eating and physical activity), weekly goal setting, problem solving and self-monitoring components that

aim to support behaviour change through promoting self-regulation and observational learning. The website also has a blog, fact sheets, and recipes.

Cullen et al. (2013) investigated the effectiveness of the website on adolescents aged 12-17 years. 390 participants (F = 157, M = 134) were recruited through flyers at community organisations, schools, churches, and health fairs, in addition to radio and newspaper advertisements. Upon parental consent (returned in person), participants were sent a link and a password to access a baseline questionnaire. Participants were then randomly assigned to the Teen Choice Website Intervention (n = 288), or a control condition website (n = 102) which did not include the role model stories, online self-monitoring, goal review and problem-solving components.

Of the 366 participants who logged onto the website during week one, 75 percent of participants logged onto the website at least once a week for the 8-week intervention period, thus suggesting that the material was engaging for both conditions. 91% of participants set goals, however intervention group participants were more likely to set five or more goals (77%) than were control group participants (23%). Information sections were accessed by 88 percent of participants, and 62.2 percent prepared at least one recipe from the website. The diary function available to intervention group participants was only used by 33 percent of participants three or more times.

Overall, 84 percent of participants said the website was helpful in helping them to become more physically active, and 90% said it was helpful in supporting them to make healthy food selections. In both conditions, the number of adolescents reporting being physically active for at least 60 minutes per day during the past week was significantly higher ( $p < 0.001$ ), and the number of participants reporting watching television for three or more hours during the past week was significantly lower ( $p < 0.01$ ). The only significant finding between the two groups was in regard to vegetable consumption, where the number of adolescents who reported eating three or more servings of vegetables per day during the past week was significantly higher in the intervention group (18.22%) than the control group (4.85%) ( $p < 0.05$ ). The significant improvements found for the control group in this study may be explained by the fact that although the control condition website did not include role model stories and had limited self-regulation components that were believed to support behaviour change (i.e. goal setting, problem solving, and self-monitoring), it could be that other aspects of the website in both conditions led to similar changes in behaviour.

### *2.2.2 Case Study: Web-based alcohol screening and brief interventions*

The following case studies from New Zealand illustrate the effectiveness of another promising approach, web-based alcohol screening and brief interventions;

Kypri et al. (2004) recruited participants from a university health centre waiting room. Those who consented to the study were led to a computer where they completed the AUDIT screening test. Those screening positive for hazardous or harmful drinking (i.e. an AUDIT score of  $>8$  and consuming more than 4/6 drinks (female, male) during the previous 4-weeks) were then randomly assigned to the control or intervention conditions. Kypri et al. (2004) found that, compared to control condition participants who were only given a leaflet after completing the screening test (n = 53), intervention participants (n = 51) who received personalised feedback on their drinking habits had significantly lower alcohol consumption, lower heavy episode frequency and fewer personal problems at 6-weeks post-intervention. At 6-months, there were no significant differences in reported alcohol consumption between the two groups, however participants in the intervention group had significantly fewer personal and academic problems.

In another trial by Kypri, Langley, Saunders, Cashell-Smith, and Herbison (2008), participants (n= 975) who screened positive for hazardous or harmful drinking were randomly assigned to one of three groups; a single web-based motivational intervention, a multi-dose intervention where participants received the intervention three times over a course of six months, or a control leaflet group. In comparison to the control group, both the single and multi-dose e-SBI groups reported lower frequency of drinking, lower total consumption (equivalent to 3.5 standard drinks per week), and fewer academic problems at 6-months. The multi-dose group also reported reduced heavy episodic drinking in comparison to the control group. At 12-months, the single dose-intervention group had significantly lower total consumption than the control group, and both intervention groups had significantly fewer academic problems and lower AUDIT scores relative to the control group. Such findings suggest that additional intervention sessions do not have an additional effect.

Although a more recent study found few significant findings between intervention and control conditions (Kypri et al., 2014), recent evidence demonstrates the intervention's effectiveness with Maori university students. In a large RCT Kypri et al. (2013) recruited participants by emailing 6697 Maori students (17-24 years) enrolled at seven of New Zealand's eight universities to invite them to participate in the study. Those who consented to the study and screened positive for hazardous and harmful drinking (i.e. an AUDIT-C score of > 4) (n = 1789) were randomised to an intervention condition (n = 733), or a screening only control condition (n = 682). The intervention condition involved a web-based alcohol assessment and personalised feedback. Personalised feedback surrounded issues that were likely to affect participants, including monetary expenditure per month, a comparison of their alcohol consumption level to the general population (of the same age and gender), and their relative risk for a traffic crash. To help increase responses to the post-questionnaire, participants were sent a pre-notice warning about the upcoming survey. Findings from the survey showed that intervention group participants drank less often, less per occasion, less overall, and also had fewer academic problems relative to control group participants. A significant finding at follow-up (5-months) was a 22 percent difference in weekly drinking, demonstrating a much larger effect than face-to-face interventions delivered in primary health care settings (13%) (Kaner et al., 2007).

The short duration of these interventions suggests that they are appropriate and easy for participants to complete at a primary health care centre (Kypri et al., 2008; Kypri et al., 2004), but also for those not visiting a primary health care centre or seeking help (Kypri et al., 2013). Kypri et al. (2004) also suggest that interventions may remove barriers to discussing alcohol issues, especially with University students who would be unlikely to engage in a discussion about their drinking with a health-care professional which was not self-initiated (Kypri, Langley, McGee, Saunders, & Williams, 2002).

### 2.3 Online games

The use of online games is a relatively new approach for health promotion and, as a result, there is again very little evidence demonstrating its effectiveness on health behaviour change. While more research is needed, Baranowski, Buday, Thompson, and Baranowski (2008) identify a range of video game features that demonstrate their potential for delivering messages and leading to positive health behaviour change, including their engaging, attention-maintaining properties, extensive player involvement, and interactivity. Video games also have features that can support behaviour change theories (e.g. SCT), including a game's moral story, tailored messages and/or goal setting. Notably however, drop-out rates and non-completion can be high (Baranowski et al., 2008). Although the following example of a New Zealand designed game aimed at providing



cognitive behavioural therapy to youth with depression is not a 'true' health promotion intervention, it does clearly illustrate the use and acceptability of online games among youth populations;

### 2.3.1 Case Study: SPARX

SPARX is an interactive, three-dimensional fantasy game designed to deliver computer based cognitive behavioural therapy for the treatment of clinically significant depression. The game's setting is a fantasy world that is dominated by 'Gloomy Negative Automatic Thoughts' (GNAT's), where users chose an avatar and undertake a series of challenges that work towards restoring the balance of GNATs. In each of the seven modules, users interact with a guide who sets challenges, provides education, and gauges mood. If a person's mood is not improving, they are prompted to seek additional help. The game can be delivered by CD-Rom (compatible with computers with low specifications) (Merry et al., 2012), and has recently become available online (SPARX, 2014).

In a randomised control trial, Merry et al. (2012) compared the effectiveness of SPARX to treatment as usual. Participants were recruited through school based counseling services, general practices, and youth clinics. Participants were 187 adolescents (12-19 years) with clinically significant moderate to severe depression scores (between 10 and 19 on the PHQ-9 measure) (Kroenke, Spitzer, & Williams, 2001). Results found that SPARX was as effective as treatment as usual; at post-intervention, there was a mean reduction of raw scores on the children's depression rating scale-revised, with a reduction of 10.32 in the SPARX group compared to 7.59 in the treatment as usual group (between group difference 2.73, 95% confidence interval -0.31 to 5.77;  $p = 0.079$ ). Although the study was underpowered to detect gender or ethnic differences, the study found that the intervention was more effective among those who were more depressed. There was a low drop-out rate in both groups (9%) and, in the SPARX condition, 86 percent of participants completed at least four modules, while 60 percent completed all seven.

In a study investigating the views of alternative education students ( $n = 39$ ) (74% males, 49% Maori, 38% Pacific Island, all aged 13-16 years) on depression, help seeking, and computer programmes to assist depression (i.e. SPARX), Fleming, Dixon, and Merry (2012) found that, although participants were very reluctant to talk about depression with health providers, their interest in computer games to assist depression was high, irrespective of gender, ethnicity, or past experience of feeling down. SPARX thus has the potential to lower costs and increase access through delivering the intervention to those not wanting to seek help from professionals, or those who cannot access professional help due to work shortages (Mariu, Merry, Robinson, & Watson, 2012). In another study, Fleming and Merry (2013) found that youth work service providers, who were largely supportive of the use of computer-based cognitive behavioural therapies (e.g. SPARX), wanted to be able to deliver such therapies in group settings to extend its reach to vulnerable young people (Fleming & Merry, 2013). This would be particularly efficacious in increasing access given that computer access is a barrier for some young people (Fleming et al., 2012).

## 2.4 Social Media

Social networking is now an established part of the online environment, with young people being the most frequent users of social networking sites (Facebook, MySpace, LinkedIn, Twitter) (Gold et al., 2011). The increasing use of social media and its interactive functionality has prompted calls for its use in health promotion; as Gold et al. (2011) state, "...[social networking sites] provide a medium of enormous potential for health promotion both in terms of audience reach and

interactive functions that could be exploited for intervention delivery” (p. 2). Norman (2012) further encourages people to look at the use of social media beyond facilitating behaviour change; “A closer look at the opportunities and challenges that social media presents for health promotion requires going beyond technology toward a rethinking of the social relationships it helps to facilitate” (p.3). In contrast to other media forms (e.g. radio, print, and television), the interactive capabilities of social media are advantageous for health promotion in being able to work towards strengthening community action, developing personal skills, and creating supportive environments.

Other benefits of social media includes its ease of use, low cost and, as social media is all ‘cloud based’, reduced reliance on specific devices (Norman, 2012). Upon reviewing social media sites on sexual health promotion, Gold et al. (2011) found that the most popular pages were those that encouraged interactivity by posting regular posts and delivering content designed for use on social media. However, despite the use of social media in health promotion being praised for its interactivity, they also found that a lot of sites were ‘static’ and only extended information from their websites to social media pages. Unfortunately there is no published literature on the effect of social media interventions on health behaviour, however Gold et al. (2012) provide valuable insight into how social media sites can encourage interactivity.

#### *2.4.1 Case Study: The FaceSpace Project*

The FaceSpace Project trialled the delivery of social media based sexual health promotion interventions with two groups, including young people (16-29 years), and homosexual men. These interventions involved creating several fictional characters that interacted with each other and the public online. Each character posted regular status updates, and shared videos relating to sexual health. The sites were popular (900 and 1332 fans per page, respectively), and videos were viewed up to 3188 times. Drawing on their experiences with the 6-month FaceSpace Project, Gold et al. (2012) provide several recommendations to aid the development of health promotion interventions delivered through this medium;

- Establish a multidisciplinary team; familiarity with social media alone is insufficient, and thus it is important to have people with additional expertise and knowledge of how social media works, and how users interact and engage online.
- Allow time for seeking approval (e.g. ethical, legal, organisational concerns), especially as social media interventions are a new medium that most people are not familiar with.
- Ensure that there are sufficient resources for developing and maintaining sites – while they have a large reach and are cheap to produce, a lot of time and resources are needed creating, developing, and maintaining sites. Such tasks may include finding entertaining and educational materials, and monitoring users’ interactions
- Create an interest in the site early on; not only does a site need to look visually appealing, it needs to be active to attract appeal. Promotion of the intervention is also critical, and can be done through Facebook advertisements, photo tagging, or asking other organisations with a large fan base to post a link to the page.
- Keep the audience engaged with material; Instead of simply broadcasting information, encourage interactivity and engagement through posting regular updates (e.g. videos and posts), asking questions, launching quizzes, and encouraging comments on posts.

- Define success, and how it will be measured; beyond simply gathering end user statistics, it is important to integrate a range of evaluation methods (e.g. focus groups and questionnaires).

## 2.5 Potential of internet based approaches with youth

The above case studies illustrate how health promotion has utilised various internet features to deliver interventions. Such features are likely to appeal to youth, particularly those that encourage interactivity. Use of internet based approaches have been identified as a good alternative for youth wishing to seek help for sensitive health topics or stigmatised behaviours (e.g. alcohol consumption) (Khadjesari, Murray, Hewitt, Hartley, & Godfrey, 2011), and/or those who prefer self-help (especially males) (Ellis et al., 2013).

While the many advantageous features of internet based approaches have been illustrated, limitations with the approach do exist. These limitations include perceived costs, fear of parents/friends finding out (especially for stigmatised health issues), and a lack of understanding about how services work (Bull & McFarlane, 2011; Perry et al., 2012; Willoughby, 2013). Further, as many interventions require users to log on frequently and/or at a specified time, they can also become inconvenient and place large demands on self-regulation.

Interestingly, Bradford and Rickwood (2014) identify that the increased delivery of mental health services online is based on the assumption that young people preferred to seek help online. However, in a survey investigating the preferred modes of delivery for mental health interventions among adolescents, Bradford and Rickwood (2014) found that 58.9% of participants preferred to seek help face-to-face, compared to just 16% of participants who preferred to seek help online and 1.3% who preferred help over the phone. Of particular concern is that a large number of people preferred not to seek help at all (28%), suggesting that there is still an overall orientation to not seek help at all, and/or that barriers remain to seeking help even when it is provided through other modes. While such evidence is specific to seeking help for mental health issues, it reinforces the importance of understanding how an intervention is likely to be received by a target population before implementing it.

### 3 Mobile Phone based Health Promotion

Globally, 91 percent of people have access to a mobile phone (DigitalBuzz, 2013). In developing countries in particular, mobile phones have become an important form of communication as they have a much broader reach than other communication technologies (e.g. landlines, television, internet) (Lim et al., 2012). Promisingly, mobile phone interventions enhance the potential of reaching hard to reach groups (e.g. youth, those who change their address frequently, or those not accessing health services regularly) and underserved populations who may face barriers to accessing other technology modes (Proudfoot, 2013).

As the following will highlight, there is emerging evidence to demonstrate the effectiveness of mobile-phone based health promotion interventions in addressing a wide range of health issues. Although delivery modes vary, there are many key advantageous features of mobile phone based health promotion interventions. First, they provide a convenient approach for users as they are a direct link of contact at any time or place (Guerriero et al., 2013; Shaw & Bosworth, 2012). Second, although the small screens of mobiles may limit program complexity (Bull & McFarlane, 2011), it means that it is very easy to update content, and thus places fewer demand on staff running interventions (Bull & McFarlane, 2011). Third, mobile-phone based interventions are possibly one of the lowest cost approaches in health promotion (Buhi et al., 2013), however it is important to be mindful of the costs incurred to users (Bull & McFarlane). A final key benefit of mobile-phone interventions is that the medium allows for easier monitoring of participant engagement and exposure (Fjeldsoe, Marshall, & Miller, 2009).

#### 3.1 Text-Message based Interventions

The use of short-message service (SMS –or texting) is a main approach used by mobile-phone based health promotion interventions. SMS allows people to send short messages (160 characters) to others almost instantly, regardless of time or place (Buhi et al., 2013; Fjeldsoe et al., 2009). Text-messaging has rapidly become a main form of communicating via mobile phones (Buhi et al., 2013). Perhaps unsurprisingly, use of SMS is highest among youth. In one study, Rideout et al. (2010) found that youth aged 8-18 years sent an average of 118 text-messages per day (equivalent to about 1.5 hours sending and receiving). Notably, compared to email, SMS has a more conversational nature that takes place in real time, and thus people may feel obliged to reply more quickly than if something was sent over email (Lam et al., 2013). Notably, compared to email, SMS has a more conversational nature than functions in real time, and thus people may feel the need to reply more quickly than if something was sent over email (Lam et al., 2013).

SMS-based health promotion approaches have been found to be effective in encouraging a wide range of positive health behaviours, including sexual health, smoking cessation, weight-loss, nutrition, and mental health (Blackburn & Blatnik, 2013; Fjeldsoe et al., 2009; Hebden et al., 2013; Hingle, 2011; Lim et al., 2012; Rodgers et al., 2005; Whittaker et al., 2012). Reviews have found that SMS interventions have been delivered through either SMS alone, SMS and internet, or SMS, internet, and one other mode (e.g. paper diary, clinic visits, phone calls. They have ranged from four-weeks to one-year in duration (Buhi et al., 2013; Fjeldsoe et al., 2009). In one review, Fjeldsoe et al. (2009) found that the frequency of text-messages often reflected the expected frequency of targeted behaviour (e.g. smoking text-messages sent 5 times per day, physical activity text-messages sent 5 times per week). Surprisingly, only eight of the 34 studies reviewed by Buhi et al. (2013) referred to using a theoretical framework to guide behaviour change (e.g. SCT, behavioural self-regulation theory, health belief model). While both of these reviews have concluded that

SMS-based interventions are promising, they stress that more research is needed to draw conclusions (Buhi et al., 2013; Fjeldsoe et al., 2009). The following case studies exemplify how text-message based interventions work with youth, and their potential for leading to positive health behaviour change.

### *3.1.1 Case Study: Sexual health promotion*

Lim et al. (2012) investigated the effectiveness of an email and SMS-based sexual health promotion intervention. Young people (16-29 years) were recruited at a music festival (Big Day Out, Melbourne) by approaching a stall, or being approached by staff. Interested participants provided contact details and informed consent, before being asked to complete a paper-based questionnaire. In total, 994 people were recruited for the study (58% female) and were randomised to either a no intervention control condition (n = 487), or the intervention condition (n=507). In the intervention group, participants received regular text-messages (one every 3-4 weeks) for one year. Text-messages, which were previously reviewed by a focus group, surrounded sexual health and were short and catchy; for example, “Chlamydia: hard to spell, easy to catch-Use a condom” (p.70). Intervention group participants also received regular emails (8 sent over 12 months) that, unlike the text-messages, were more detailed (2-5 short paragraphs) and included links to sexual health promotion websites.

Participants were asked to complete questionnaires at three, six, and 12-months post-recruitment, and received a CD voucher for completing all three (59% completed at least one questionnaire, while 34% completed all three). At 12-months post-randomisation (39% completion rate), the study found that knowledge on sexually transmitted infections (STIs) was higher in the intervention group compared to the control group. Although knowledge does not necessarily equate to behaviour change (Taylor, 2009), increased knowledge could assist with decision making regarding sexual health practices. At 12-months, Lim et al. (2012) also found that women in the intervention group were more likely to discuss sexual health topics with a clinician, and were more likely to have had a STI test. Such findings are encouraging, especially because early help seeking could minimise secondary complications (Lim et al., 2012). Other promising findings are that over three quarters of participants reported that they shared some of the text messages with others, thus helping to spread message content beyond those directly involved in the study. Notably, although 69 percent of participants found the text-messages entertaining or interesting, 24 percent found the text-messages annoying. As the study had quite a large age range, it could be that the text-messages were found to be annoying among older age groups, for example, or those that already practised healthy sexual health behaviours. Overall however, the intervention is very promising and warrants more investigation into increasing its effectiveness with young males.

### *3.1.2 Case Study: TXT 2 Quit*

In a randomised controlled trial, Rodgers et al. (2005) investigated the effectiveness of a text-message based smoking cessation programme in New Zealand. Participants were recruited through nationwide media advertisements, popular webpages, email/phone mailing lists, and posters displayed at tertiary institutions. Participants were 1705 smokers (58% female, mean age = 25) who were interested in quitting smoking in the next month. Upon consenting to the study over text-message, participants were randomised to a control group or an intervention group. In both conditions, participants were able to continue with smoking cessation programmes.

Control group participants (n = 853) received one text-message every two weeks thanking them for being in the study, providing study contact details, and reminding them of the incentive (one

free month of text-messages). In the intervention group (n = 852), participants received regular personalised text-messages (developed by a multidisciplinary team) that were individualised to participant characteristics (e.g. nicknames, preferences, smoking history, barriers to cessation). Half of the text-messages related to information on smoking cessation, including motivational support (e.g. smoking cessation success stories, feedback on life years save, and feedback on money saved), and advice (e.g. expected symptoms to expect when quitting, tips to manage cravings). The other text-messages were 'distraction' text-messages about general interest topics (e.g. sport, trivia). Intervention group participants also chose a quit day. In the week leading up to the quit day, and for 4-weeks after, participants received five text-messages per day. On the quit day, participants were given a free month of text-messages and were encouraged to tell their friends and family of their quitting as it was thought that this would help to encourage communication and support, and provide distraction. Intervention group participants also had text-access to a 'Quit Buddy' (participants with similar characteristics), 'TXT crave' (where they would receive a message with advice on how to manage a craving), and TXT quizzes. At 6 weeks post-randomisation, text-messages dropped to three per week until the 6-month follow up and were all focused on maintaining cessation.

At 6-weeks post-randomisation, more participants had quit smoking (that is, not smoking in the past week) in the intervention group (28%) than the control group (13%). When participants were asked about their confidence in staying smoke-free, answers were more confident in the intervention group. There was also a small reduction in the number of cigarettes smoked per day among those in the intervention group still smoking at 26 weeks. The study had a moderate attrition rate, with 67% of intervention participants and 78% of control participants completing the final six-month follow up questionnaire (the smaller attrition rate in the control group may be explained by the fact they were reminded of the incentive for participating). In another study, Bramley et al. (2005) found that the intervention was as effective with Maori, finding that more Maori participants had quit smoking in the intervention group (26.1%) than those in the control group (11.2%). Overall, this intervention demonstrates a promising approach to supporting smoking cessation, and has since been implemented as a free nationwide service for people wanting to quit smoking (Milne, Bowler, Li, & Salmon, 2009).

### 3.2 Other mobile phone based approaches

While text-message based approaches appear to dominate the literature, the advancing capabilities of mobile phones are providing other ways to deliver interventions (e.g. phone applications, multimedia messages). Smartphone applications have been used extensively in mental health care, including for patient-physician communication and self-monitoring (Donker et al., 2013; Luxton, McCann, Bush, Mishkind, & Reger, 2011). Key features of such interventions include real time virtual coaches (with audio and visual instruction), homework tasks and the ability to date stamp them to demonstrate treatment compliance, integration of calendar and phone contacts to help people track appointments, and real time symptom and activity monitoring that can be reviewed by a physician. Although the use of smartphone applications in health promotion is scant in comparison, it is assumed that, in addition to the advantageous features of text-message based interventions, novel approaches may be able to help engage users with their appealing visual graphics and greater interactivity (e.g. audio and video components). Notably however, it is important to be mindful of the fact that some mobile phones may not be compatible with advanced features, and as a result, could compromise an intervention's reach. The following case study demonstrates the potential of using advanced mobile phone features;

### 3.2.1 Case Study: MEMO

Whittaker et al. (2012) report on the development of a mobile phone based intervention aimed at preventing depression in youth. Participants were recruited from 15 Auckland high schools where students were told about the study being a mobile phone program about “living in a positive place”. 1348 students aged 13-17 years volunteered to participate in the study, and were asked to give written consent (their parents could opt them out of the study if they wished), and to complete a baseline questionnaire. As the program aimed to prevent depression, any students who were identified as having depression symptoms or at risk of self-harm were excluded from the study and referred to school guidance counsellors immediately. All participants took part in a nine-day run in period to ensure that participants could view the message content (including the videos and website), but also to allow participants to share initial messages with friends without potentially contaminating the conditions. During these nine days, participants were also asked to take part in an interview where they were again assessed for depression.

885 participants (68.3% female, 31.7% male) were eventually randomly assigned to the intervention condition, or the control condition. In the intervention condition (n = 426), participants received two messages a day for 9 weeks. Messages were derived from 15 key messages from cognitive behavioural therapy, and delivered over video, text and cartoon messages, and a mobile website. In the control condition, participants received the same number of messages, however these had different content. At 9 weeks post-randomisation, participants took place in an interview looking at engagement with the program and perceived usefulness (completed by 97.7% of participants). Results from these interviews found that over three-quarters of participants viewed at least half of the messages. 66.7% of intervention group participants said the intervention helped them to be more positive, and 50.2% said it helped with negative thoughts. Further, 90.7% of intervention group participants said that they would recommend the programme to peers.

The overwhelming majority of intervention group participants liked the types of messages that were used (video messages from celebrities = 78.0%; videos from other teens = 71.8%; animated cartoons = 65.8%; and text-messages = 60.3%). 82.4% of intervention participants thought that the intervention would be useful, but this was higher among female students than male students. Among those who did not think it would be useful, primary reasons included that it did not change they way that they thought (n = 15), that they did not have any problems and/or were already happy so did not need help (n = 15), that they had technical difficulties (e.g. videos too slow to download, lost/broken phone) (n=15), that the issues covered were minor or not relevant (n = 10), or that it was boring or had nothing new (n = 7). While findings on clinician rated depression at 12 months among participants is yet to be published, the reviewed study demonstrates strong potential for the use of multimedia content in interventions with this age group.

### 3.3 Potential of mobile phone based approaches with youth

In comparison to internet based interventions, mobile phone based approaches have been praised for being more convenient, straightforward, and do not rely on users to access computers at scheduled times (Virginia, 2011). As mobile-phone users are likely to have their phone on them and within reach most of the time (Gold et al., 2010; Proudfoot, 2013), it is easy for people take part in interventions as they can participate at anytime and anywhere. Such features are likely to be particularly advantageous for use with youth populations, particularly due to the few demands on self-regulation.

Participants in mobile phone based interventions have signalled their acceptance of the medium; as Gold et al. (2010) found through focus groups with participants in the sexual health promotion study (Lim et al., 2012). Many participants thought the approach was an acceptable and personal means of health promotion. Participants described the text messages as being more personal than large billboard advertisements for example, and also the information more 'casual' than if a doctor or teacher was providing it. A review on Youthline's text-counselling system offers valuable insight into why text-message approaches may be popular with youth, including that they are private, are controlled by the user, and the ability to store text-messages on a phone means that a user can look back over a text-message history for support (Haxell, 2014). The simple and brief nature of text-messages may also appeal to youth, who may also appreciate the confidential and non-confrontational approach of many interventions (Perry et al., 2012; Waller, Franklin, Pagliari, & Greene, 2006).

While advantageous in many respects, key limitations of mobile phone interventions to users include technical issues, such as poor network coverage, battery life (Luxton et al., 2011). The intensity of interventions could also become an annoyance overtime, and Seko, Kidd, Wiljer, & McKenzie (2014) highlight that high intensity self-monitoring could result in feelings of shame and guilt. A final limitation is that while advanced mobile phone features offer increased interactivity, interventions that use such features are unavailable to users without compatible mobile phones.



## 4 Limitations/Challenges of Technology-based approaches

As illustrated, the strengths of technology-based health promotion interventions are plentiful. However, in addition to the highlighted user limitations (e.g. perceived costs, fear of parents finding out), it is important to be mindful of the following limitations and challenges of technology-based approaches to health promotion practice and research;

### Practice limitations:

- Digital divide: Although technology access and use has increased, those without the latest technologies may not be able to access interventions that require advanced technology features. Further, users with slow internet connections may not be able to access content that uses high quality graphics (Bull & McFarlane, 2011).
- Participant verification: Interventions that recruit participant remotely through technology have less control over who signs up to interventions, as it is harder to verify participants' identities. Further, once a participant signs up to an intervention, there is no guarantee that it is that same person who completes the actual intervention.
- Time consuming: interventions can be time consuming for staff, whether this be finding new information to share on a website and/or social media, or monitoring replies to text-messages (Bull & McFarlane, 2011; Norman, 2012).
- Attention spans: interventions have to compete for participants' attention spans, especially on the internet where there are numerous distractions (e.g. social media)
- Technological obsolescence; as new technology continues to emerge and develop rapidly, Bull and McFarlane (2011) warn that by the time an intervention is researched and showed efficacy, the technology approach used may be obsolete. While mobile phones and internet are well established and there is a lot of flexibility in their use, technological obsolescence is especially important to be aware of when using highly specific technology, such as CD-Roms.

### Research limitations

- Common research limitations of technology-based interventions include small sample sizes, self-report measures (subject to memory error and reliability concerns), skewed data and short-term follow up (Khadjesari et al., 2011; Miller, 2007). The majority of interventions also use selective samples (e.g. University students) that limit generalisability, and people who sign up to interventions may already be motivated to change their behaviour.
- High loss to follow-up is common in technology-based interventions (Bailey et al., 2013; Bull & McFarlane, 2011). While interventions may still have enough power to find significant effects, it is important to be mindful of the bias that a high loss to follow-up could introduce; whereby those who drop out of the study differ to those who stay in it (Lim et al., 2012).
- There are numerous features of interventions that have not always been well evaluated, including engagement, message content, duration, intensity, and cost-effectiveness. There is also a lack of research looking at long-term outcomes, and how well interventions work in comparison to treatment as usual. Standardised measures are needed to help evaluate such components.

## 5 Recommendations for practice and research

The following recommendations closely consider the findings from the literature discussed in this review, including how potential limitations and challenges can be minimised. This information holds particular relevance to those wishing to develop technology based health promotion interventions;

### 5.1 Ethical considerations

Bull and McFarlane (2011) outline a number of ethical considerations that are of importance when delivering interventions via technology;

- **Beneficence:** interventions should be targeted towards populations who may otherwise not have received help. Further, although a major advantage of technology is its broad reach, interventions should still be deemed effective before being implemented with large populations.
- **Transparency:** it is important to make information as clear as possible to participants. An advantage of online consent forms is that content can be spread over multiple pages, and thus people can consent to understanding the information as they read it. It is also important to display research contact details prominently so that participants know who they can contact should they have any questions or concerns. Finally, people can lie about who they are in order to fit the requirements for the study; in order to control for this, it is important to try and limit advertising to the target group, and/or to recruit face-to-face where it is easier to verify participants' identities.
- **Equity:** not all technology modes are accessed equitably among different groups. While it may be tempting to use the latest technology, it is important to consider what approaches will be able to maximise reach in the targeted population.
- **Confidentiality and data security:** although participation in an online intervention allows users to take part anonymously, it is important that their data is kept secure. There are ample tools available for online data security, but researchers should also take care in ensuring that stored data is kept safe (e.g. keeping computer files password protected and storing portable hard-drives safely).
- **Working with youth:** parental consent is needed for minors to participate in research interventions. Further, in light of fears of online predation, Bull and McFarlane (2011) emphasise the importance of ensuring that information about an intervention is as transparent as possible to assure participants and/or their parents of the study's legitimacy.

### 5.2 Development/Practice recommendations

As technology-based approaches become more widely used for health promotion, it is critical to understand what characteristics affect the acceptability, utility, and efficacy of interventions. Although challenged by a current lack of research, the following recommendations could help optimise the development of future technology-based interventions;

Firstly, a lot of thought and planning needs to go into the message content of websites and text-messages to ensure that it is novel and engaging, and to help increase the likelihood of attention being given to them. The following points related to text-message content are applicable to all communication with youth through technology media;

- Youth like text-messages that use casual language, especially as they are less directive than traditional health promotion approaches (Gold et al., 2010).
- Short, positive and witty text-messages are more likely to be shared and remembered by receivers (Gold et al., 2010). Youth also like text-messages that rhyme, are enthusiastic, personally relevant, and aligned with interests and upcoming events (Ellis et al., 2013; Gold et al., 2010; Woolford et al., 2011).
- Using text-language can help increase rapport with youth (Haxell, 2014). However, using acronyms such as 'LOL' has been considered by youth as too informal for use by healthcare providers (Woolford et al., 2011).

In addition to content, website design is a key feature of internet based interventions. The following outlines key recommendations to help make the design and content of websites appealing and engaging, This is important to not only maintaining engagement with the intervention, but also to help make the intervention appealing to potential participants;

- Website content should be clear, up to date and relevant (Youthline, 2014).
- The design of a website should be bright and have a clear layout that makes it easy for users to navigate between points (Youthline, 2014).
- Websites should use images and videos that users can relate to, and these should represent the diversity of users (e.g. varying ethnicities) (McCarthy et al., 2012; Youthline, 2014).
- Websites should be considerate of potential literacy issues among users; using avatars, sound, and videos can assist young people with literacy issues (Youthline, 2014).
- Websites should include functions that allow users to interact with other young people online (McCarthy et al., 2012).
- Including real-life stories are appealing to young people, however if famous people are used to present information/share life stories, it is important that the person is someone that youth can relate to (Youthline, 2014).
- Interactive features such as videos and sound should not play automatically; they could be slow to load, but may also cause embarrassment to the user if they are in a public space (Youthline, 2014).
- Links to other reputable websites should be displayed prominently on the website, as they may be able to provide more detailed information and support on specific health issues.
- Finally, websites should be optimised so that they are compatible for clear viewing on smartphones and/or tablets.

Loss to follow-up is high in field research (Lim et al., 2012). The following points are recommended to assist with engagement throughout interventions;

- Sending a pre-notice warning email about a follow-up questionnaire (e.g. Kypri et al., 2013), and/or sending reminder text-messages.
- Use incentives such as prize draws (Bailey et al., 2013; Youthline, 2014).
- Personalise messages to each participant if possible, as untailed messages have been found to have a higher attrition rate than personalised messages (Fjeldsoe et al., 2009).

As the reviewed literature has demonstrated, there has been very little use of theory and behaviour change techniques. As using theory and behaviour change techniques are considered vital to behaviour change interventions (Thompson et al., 2010; Webb, Joseph, Yardley, & Michie, 2010), the following recommendations should be considered to help optimise an intervention's impact on behaviour;

- Theory is important towards understanding why people engage, or do not engage, in certain health behaviours (Taylor, 2009). Use of a theory can help ensure that potential barriers to behaviour change are addressed from the outset of an intervention. There are numerous theories that may assist behaviour change (e.g. SCT, health belief model), but it is important to consider the strengths and limitations of each theory before implementing it.
- Interventions should also explicitly identify how varying aspects of an intervention fit with components of the Ottawa Charter. As earlier explained, developing an intervention that fits with the varying Ottawa Charter components can be easily achieved; for example, creating *Supportive Environments* can be supported by online interventions by adding, and encouraging the use of, an online forum where users can share experiences and provide support to one another.
- In New Zealand, varying cultural models of health should be considered when developing an intervention. For example, a Maori model of health, Te Whare Tapa Wha, uses the analogy of a house to identify four interdependent cornerstones that are essential to achieving a balance of health, including physical, spiritual, psychological and family dimensions (Durie, 1994). Consideration of these cornerstones is important towards ensuring that an intervention is culturally relevant, and may also assist behaviour change by addressing the many factors that affect health.

Other recommendations to consider when developing a technology based health promotion intervention include;

- Having a run-in period is advantageous as it ensures that an intervention works with the participant's technological device, and allows for excited participants to share the content of messages with friends without potentially contaminating other conditions (especially if they have friends who are participating in the study too) (Whittaker et al., 2012).
- Engaging adolescents in the development of programmes to help ensure that they are appealing and relevant to youth
- Users may falsely expect immediate responses to messages (Luxton, Jane & Kinn, 2011), and therefore it is important to clearly specify expected response time with clients.
- Use peer examples that participants can relate to (Woolford et al., 2011)
- Use short, online questionnaires to measure behavior change. Questionnaires should also ask participants about their experiences with the intervention, as this will help inform future practice about how interventions are received by users
- Building a brand for a study can also help to make it look more reputable. If an intervention is using several components (e.g. website, social media, email, recruitment posters), a brand may also help to make the intervention identifiable across each of these.
- Finally, it is important to keep up with trending websites and technologies (e.g. SnapChat), and to think about the way in which these could be used to deliver health promotion

interventions. However, it is also important to be mindful of how quickly some technologies can become obsolete.

### 5.3 Research recommendations

Research is essential to not only attribute success, but also to maximise the reach, impact and potential of future technology-based interventions. It is thus important that all interventions are measured as rigorously as possible. The following points have been identified as important areas for future research on technology-based interventions;

- Research should be prioritised with youth populations who are already embracing technology (Buhi et al., 2013)
- Generalisability: it is important to recruit from the average population to make results more generalisable. As an example, Lim et al. (2012) recruited participants from a music festival meaning that the sample was likely to be more representative of the average population than a sample recruited through a clinical setting. As aforementioned, recruiting face-to-face is also recommended as it helps to verify participants' identities.
- Effectiveness (including cost-effectiveness) should be compared to treatment as usual to help determine whether interventions have the potential to supplement current approaches.
- Interventions should explicitly state what theory they are based on, and how they fit the theory components (Fjeldsoe et al., 2009).
- Research is needed to determine the effectiveness of interventions in different contexts
- Research should use objective and verified measures of behaviour to ensure that they are measuring the targeted behaviour(s) (Fjeldsoe et al., 2009).
- The optimal duration and intensity of interventions needs to be investigated to help inform practice, although it is appreciated that this may vary depending on the health behaviour that interventions are targeting.
- Longitudinal research is needed to look at the long-term impact on behaviour change, and whether or not behaviour change is sustained.
- More attention is needed to evaluating the finer aspects of interventions that could help inform practice, such as webpage layout, colours, and content.
- More research is needed into SMS characteristics (e.g. text language), and what characteristics may impact on behaviour change and/or increase rapport with the target population. It is also important to investigate how SMS messages are treated by participants, and if messages stored in inboxes are reviewed for future reference
- Process measures that may impact on behaviour change also need to be reported, including the number of sent/reply SMS messages, participant engagement, and attrition (Fjeldsoe et al., 2009).
- Norman (2012) stresses that research evaluating health promotion outcomes need to acknowledge social media's complex and evolving nature. Although specific to social media, this is an important point that is applicable to all technology-based interventions, especially as technology is developing so rapidly.

## 6 Summary

As this literature review has demonstrated, there is a wide variety of emerging technology-based health promotion approaches. The reviewed examples demonstrate a promising step forward in reaching youth through media that are appealing and that they are already familiar with. Aside from being among the most frequent users of technology, this review has illustrated several reasons as to why technology-based health promotion interventions may be popular and appropriate for use with youth populations. It is important to note, however, that only a small selection of literature has been summarised, and thus findings such as small attrition rates are not generalisable. Further, a general lack of consensus in the literature about how interventions should be evaluated limits how well conclusions can be drawn with certainty. The small amount of published literature to date is only the start of our knowledge in this field; more rigorous research will help to inform practice and future development by identifying what appeals to target populations, and what results in behaviour change. Although literature has stressed concern over the digital divide, it appears that increased access to technology is bridging this divide. However, in order to ensure that a new digital divide is not created whereby interventions are only accessible by those with access to the latest technology, it is important that interventions closely consider what approaches will have the broadest reach with their targeted population. In light of such considerations, it is time to embrace the use of technology in health promotion, to develop interventions, and to maximize their public health benefit by delivering them to populations who are already engaged with technology.

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