



Queensland University of Technology

Submission for the Inquiry into Personal Health Promotion Interventions Using Telephone and Web-based Technologies

Health and Ambulance Services Committee

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Witness Availability:

All authors are available to appear as witnesses as part of this inquiry.

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Professor Rebekah Russell-Bennett is a leading social marketing researcher at the School of Advertising, Marketing and Public Relations, Queensland University of Technology. Rebekah is the immediate past president of the Australian Association of Social Marketing (the national peak industry body for social marketing), author of over 130 refereed articles and a global leader in social marketing. Rebekah has collaborated in the area of telephone and web-based interventions for social issues such as blood donation, alcohol use, breastfeeding, public transport and energy use. Notable projects are the *Reduce Your Juice* energy reduction program (\$6.5 million project funded by the federal government) with CitySmart to develop a smartphone app game designed to reduce energy consumption in low-income earners and the world's first two-way automated SMS program for breastfeeding—*MumBubConnect*.



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Professor Judy Drennan is leader of the Services Innovation Research Program within the Faculty of Business at the Queensland University of Technology. She has particular research expertise in examining the impact of technological interventions on youth wellbeing, winning both an ARC Linkage grant and an ARC Discovery grant for interdisciplinary studies in this area. As a founding researcher on the Young and Well Cooperative Research Centre (CRC) Safe and Well Program, she is highly skilled in developing and evaluating mobile app interventions for behavioural change in the field of social marketing. Judy has published over 100 refereed academic papers, and has a strong record in industry-related research. She is also a Board Director for the International Social Marketing Association.



3. Rory Mulcahy

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Rory Mulcahy is a final year PhD Candidate and senior research assistant at the School of Advertising, Marketing and Public Relations, Queensland University of Technology. Rory's research is focused on the use of digital technology for behaviour change, in particular the use of smartphone apps and games. His research has informed the development and evaluation of real-world projects, including the *Reduce Your Juice* energy reduction program, which uses a smartphone app game to influence energy behaviour. Notably his work has also been recognised for an award at the World Social Marketing Conference 2015.



4. Associate Professor Daniel Johnson
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Associate Professor Daniel Johnson is the head of the Games Research and Interaction Design Lab, the leader of the Gaming Research Group at the Young and Well Cooperative Research Centre and an Associate Professor in the Bachelor of Games and Interactive Entertainment at Queensland University of Technology. Daniel has also worked in the games industry for companies such as NextGenVideos and The Binary Mill. He was a post-doctoral fellow at the University of Cambridge, working for the Engineering Design Centre and remains an Affiliate member of the Cambridge University Well-being Institute. Notable projects are the: \$2.2 million eTools for Wellbeing Project to develop and evaluate digital tools to improve health and wellbeing; ARC funding (\$360,000) exploring visualisation of genetic sequences with applications for healthcare; and \$2.7 million of funding from the Movember Foundation.

5. Professor Marcus Foth
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Professor Marcus Foth is founder and director of the Urban Informatics Research Lab, and Professor in Interactive & Visual Design, School of Design, Creative Industries Faculty at Queensland University of Technology. Marcus's research focuses on the relationships between people, place and technology. His recent studies have applied design thinking approaches in order to evaluate and innovate behaviour change programs. This has included Australian Research Council funded studies into food and technology in collaboration with Queensland Health, community engagement programs with Brisbane City Council, blood donor loyalty for the Blood Service of the Australian Red Cross, and flexible work space arrangements for the Queensland Department of Science, IT, Innovation and the Arts (DSITIA). Marcus has received over \$4 million in national competitive grants and industry funding.

6. Professor Neil King
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Professor Neil King is an internationally recognised researcher in the field of obesity, physical activity and appetite control. He has achieved an international reputation in obesity research based on developing research themes of 'Resistance to Lose Weight', and 'Susceptibility to gain weight'. He developed a hand-held electronic device for monitoring appetite and an electronic testing platform for measuring food and nutrient preferences. His multidisciplinary research includes nutrition, psychology, obesity and physical activity. He has published in journals with over 25 different titles and 7 Field of Research codes. He has published over 120 peer-reviewed articles and book chapters. He has an h-index of 35, an average of >340 citations/year since 2007. He has attracted more than \$3.5 million in research income. He has supervised 16 PhD and Masters students and has been invited to present at over 30 national and international conferences.

Submission Summary

- Telephone and web-based technologies such as SMS, smartphone apps, gamification, online/mobile games, online quizzes and tools can be used in personal health interventions in two ways:
 - health promotion (focused on attitude change, awareness, knowledge)
 - social marketing (focused on changing behaviours through commercial marketing principles).
- Helping people lead healthier lives takes more than a fancy smartphone app or an online quiz. The use of telephone and web-based technologies for personal health relies on an integrated approach rather than a single campaign.
- Social marketing is a behaviour change approach that has been proven to be effective in changing health behaviours around the globe and more effective than health promotion on its own.
- There is a need for the Queensland Government to be innovative in their approach to personal health as previous efforts using traditional approaches have not succeeded.
- The effectiveness of telephone and web-based technologies for personal health depend on:
 - balancing the entertainment aspects of the technology with the behaviour management aspects
 - providing benefits to the user
 - objectives that are behaviour-focused rather than just attitude or awareness-raising
 - providing accurate and legitimate information
 - appropriate behaviour change features
 - minimal/low cost to users.
- For the Queensland Government to be effective in its use of telephone and web-based technologies there needs to be:
 - a behaviour focus—not just attitudes and awareness
 - longevity—beyond the political cycle and involve non-profits
 - a comprehensive systems approach—embed across government
 - use of a design approach
 - a framework for design—a theory-led approach
 - an effective evaluation methods—appropriate, scientific and evidence-based
 - a customer-focus—let the user lead the way.

Telephone and Web-based Technology Interventions

Telephone and web-based technologies such as SMS, smartphone apps, gamification, online/mobile games, online quizzes and tools can be used in personal health interventions in two ways: health promotion or social marketing.

There appears to be a great deal of confusion in government circles about the terms 'social marketing' and 'health promotion' and often they are used interchangeably when they are actually significantly different approaches. Social marketing is the science and practice of behaviour change and involves goods and services that offer a value proposition, and which incentivises citizens to change their behaviour voluntarily. However, social marketing is often mistakenly used to describe advertising and communication or social media marketing.

"Social Marketing seeks to develop and integrate marketing concepts with other approaches to influence behaviour that benefits individuals and communities for the greater social good"

International Social Marketing Association 2013

Social marketing is one of three approaches to social change that can be used by government and non-profit organisations, with the other two being education (health promotion) and law/policy (see Figure 1). The three approaches typically work together, particularly when the issue is complex such as obesity or alcohol overuse; however, they each have different aims and outcomes.

Figure 1. Continuum of social change strategies¹



The distinction between social marketing and health promotion is critical when considering the use of telephone and web-based technologies for improvements in personal health as they deliver different outcomes; health promotion aims to educate, inform and raise awareness of a health issue while social marketing aims to change behaviours using commercial marketing techniques such as segmentation,

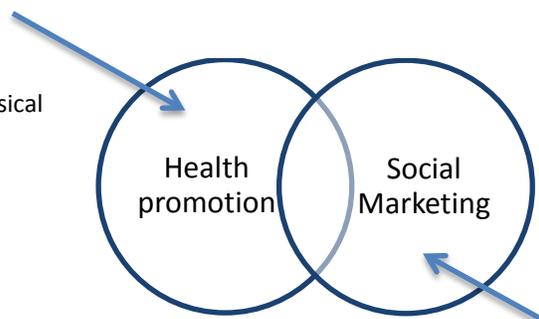
¹ Rothschild, M. .L (1999). Carrots, Sticks, and Promises: A Conceptual Framework for the Management of Public Health and Social Issue Behaviours. *Journal of Marketing*, 63(4), 24-37.

consumer insight and marketing strategies.² Health promotion typically evaluates interventions using metrics such as communication/advertising recall, attitudes and knowledge, while social marketing evaluates interventions using metrics such as product/service usage and specific behaviours. Health promotion and social marketing can be used separately or together depending on the outcomes desired. In this submission we refer to 'social marketing' as this is the approach most closely aligned with the government priorities of behaviour change.

Figure 2. Health promotion and social marketing

Technology that:

- provides practical information on how to lose weight
- provides nutrition guidelines
- show benefits of physical activity and health



Technology that:

- monitors heart-rate and daily steps
- links people to gym buddies or other socially active people
- simulates a behaviour e.g. a wii game for exercise

A systems approach to changing personal health behaviour

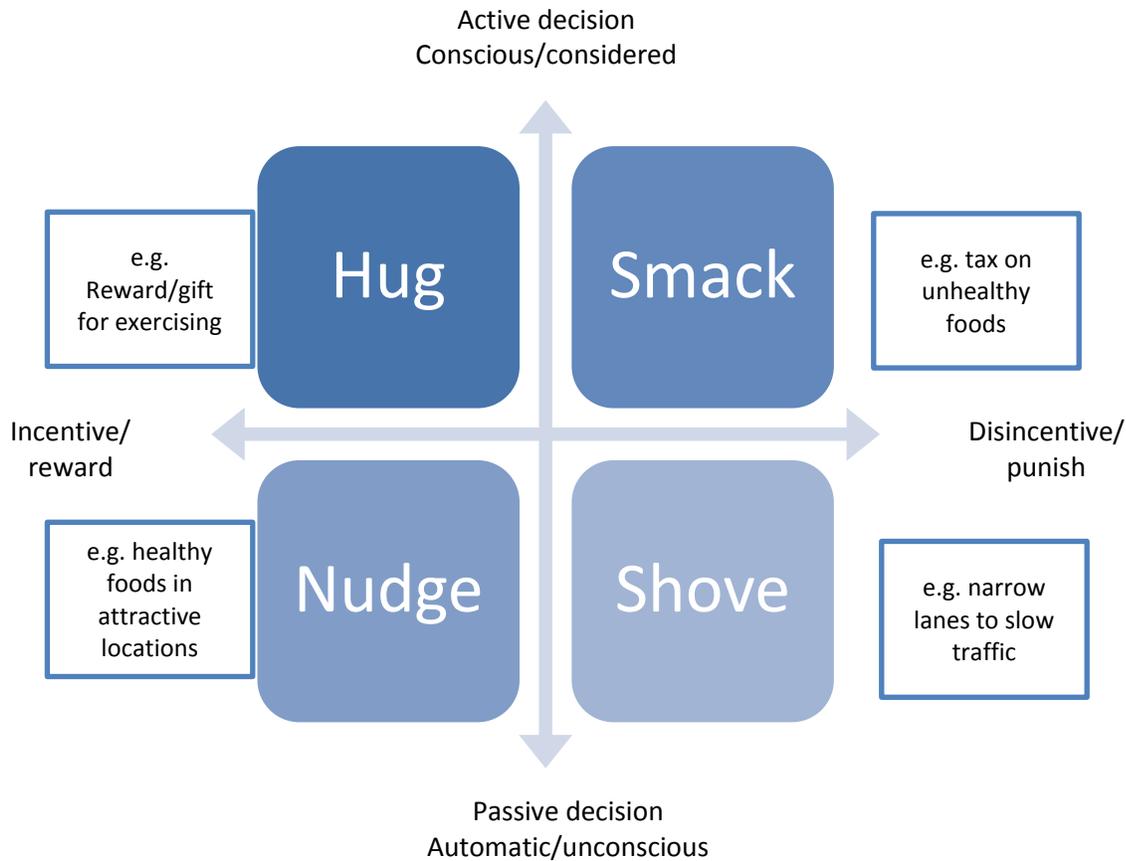
Helping people lose weight, eat more nutritious food or be more physically active takes more than an elegant smartphone app or an online quiz. The use of telephone and web-based technologies for personal health relies on an integrated approach rather than a single campaign, and must be part of a broader strategy involving service delivery, policy, communities, laws, supply and socio-cultural changes. This approach is called a marketing system, whereby all elements of a system are involved in creating changes in personal behaviour. An example of such an approach is the *Quit for You Quit for Two* campaign by the federal government, which targeted pregnant (or planning to be) women who currently smoked or intended to quit smoking.³ Nine months later the app was been downloaded by 25,000 women (out of a possible 40,000). This program was successful as it was an individually targetted program that was embedded with a broader strategy involving tobacco legislation and policy, demarketing (plain packaging, behind the counter tactics), intermediary support (GPs and health professionals) and social norms that disapprove of pregnant women smoking.

² French, J. & Russell-Bennett, R. (2015). A hierarchical model of social marketing. *Journal of Social Marketing*, 5(2), 139-159.

³ Australian Government. (2014). More Targeted Approach. Retrieved from: <http://quitnow.gov.au/internet/quitnow/publishing.nsf/Content/mta>

A useful way to manage the system is shown in Figure 3, developed by Professor Jeff French (founder of the UK National Social Marketing Centre).

Figure 3. Value exchange strategies⁴



- A **HUG** could inform and educate people about nutrition, diet and exercise (health promotion) and have features that help people perform behaviours (social marketing), such as a link to a pedometer or shopping order (to determine percentage of healthy foods), with rewards for the number of steps, rewards/points for calories burned, distance run, or numbers of days without sugary snacks or drinks.
- This technology should be part of a broader systems approach that may also include a **SMACK**, such as a tax on less healthy foods.
- A **SHOVE** could be reduced development of roads compared to investment in healthier options such as walking or bike paths.
- A **NUDGE** could be working with local businesses (retail and restaurants/cafes) to display healthier foods in more attractive locations in-store.

⁴ French, J. (2011). Why nudging is not enough. *Journal of Social Marketing*, 1(2), 154-162.

Are nudges effective?

Of particular note is whether nudges are effective or not, which is part of a behavioural economics approach. A few years ago, with the release of the book of the same name (Nudge), many government agencies viewed this as a quick, inexpensive and light-government fix to complex problems. The enthusiasm for this approach was intensified when the UK Government formed an entire department around behavioural insights, eventually leading to a House of Lords inquiry about behaviour change approaches including nudging. Amongst the many submissions in this inquiry were social marketing submissions and a case study on obesity and behaviour change. The result of the inquiry was that while nudges can be useful they don't really work.⁵

If we are honest, most physical activity, diet interventions and campaigns have been ineffective; simply telling people to exercise more or eat less is futile. The evidence to support this is that the obesity epidemic is getting worse. Indeed, Queensland's Chief Medical Officer, Dr Jeanette Young, in her summary of the 2014 Queensland Health Report⁶), commented that, 'obesity is arguably the most confronting issue this century' and 'Queenslanders are eating too much of the wrong food and moving too little'. There is an urgent need to address the problem by thinking differently and developing innovative tools and interventions that actually change behaviour.

Evidence that social marketing works

Before considering the effectiveness of telephone and web-based technologies for personal health it is first prudent to consider the effectiveness of social marketing as an approach for behaviour change, as these technologies fall within the remit of social marketing. Two examples of technology-based social marketing interventions developed by the authors are presented as vignettes over the page: MumBubConnect⁷ and the Red Cross Blood Service App Prototype.⁸

⁵ <http://www.parliament.uk/business/committees/committees-a-z/lords-select/science-and-technology-sub-committee-/inquiries/parliament-2010/behaviour/>

⁶ <http://www.health.qld.gov.au/publications/research-reports/reports/cho-report/cho-full-report.pdf>

⁷ Gallegos, D., **Russell-Bennett, R.**, Previte, J. & Parkinson, J. (2014). Can a text message a week improve breastfeeding? Proof of Concept, *BMC Pregnancy and Childbirth*, 14, 374-385.

⁸ **Foth, M.**, Satchell, C., Seeburger, J., & **Russell-Bennett, R.** (2013) *Social and Mobile Interaction Design to Increase the Loyalty Rates of Young Blood Donors*. 6th International Conference on Communities & Technologies (C&T 2013), Munich, Germany 29 Jun - 2 Jul



MumBubConnect: increasing breastfeeding through technology

- **Aim:** To increase breastfeeding confidence and perceived social support in women to improve any breastfeeding duration.
- **Solution:** an automated two-way SMS service accompanied by a phone counselling service, website and Facebook page.
- **Participants:** 244 new mums in Australia (intervention and control groups)
- **Outcome:** Mums in the MBC program had higher levels of perceived social support, active coping and higher breastfeeding rates.



Russell-Bennett, Gallegos and Parkinson 2014



Australian Red Cross Blood Service App Prototype

- **Aim:** To increase the number of young blood donors to continue donating
- **Solution:** A participatory design approach was used to make booking easier, to keep track of personal blood achievements and to compare with others



Foth, Satchell, Seeburger and Russell-Bennett 2013

Evidence of the effectiveness of social marketing includes:

- A systematic review of 34 healthy eating studies by researchers from Griffith University for the Victorian Health Department in 2013 analysed social marketing and health promotion interventions for effectiveness in changing health behaviours. The 16 studies that met the definition of social marketing were more effective in achieving behavioural change than the 18 other studies.⁹
- The emphasis in social marketing on return-on-investment and developing interventions tailored to different population segments was reviewed by the UK Government in 2005-06 and it was noted that social marketing could offer what previous health approaches had failed to deliver in the areas of obesity, smoking, alcohol misuse and sexual health.¹⁰
- A review of the best social marketing programs in 2014 by US scholar Professor Craig Lefebvre indicates that social marketing has been able to change health behaviours by: 1) combining mass communication with low-cost, health-related goods and services, such as condom programs; and 2) changing the built environments in which people access healthier living.¹¹

⁹ Carins, J.E. & Rundle-Thiele, S. (2013). Eating for the better: a social marketing review (2000-2012). *Public Health Nutrition*, 1-12

¹⁰ French, J. (2009). The nature, development and contribution of social marketing to public health practice since 2004 in England, *Perspectives in Public Health*, 129 (6), 262-267.

¹¹ Lefebvre, C. (2014). The best of social marketing in 2014. Retrieved from: http://socialmarketing.blogs.com/r_craig_lefebvres_social/2015/01/the-best-of-social-marketing-in-2014.html

Effectiveness of telephone and web-based technologies for personal health

So why is there so much interest in using telephone and web-based technologies for personal health interventions? Technological trends in the marketplace are making it increasingly difficult for social marketers to reach consumers using traditional marketing channels. Social marketing interventions using conventional products and services, such as water counters for water conservation or condoms for sexual health, are experiencing diminishing effectiveness in encouraging target audiences to uptake and sustain behaviours.¹² In particular, the drivers for increased use of web-based technologies for personal health include:

- In light of the technological trends in the marketplace and diminishing marketing effectiveness of previously used social marketing products and services, social marketers have been encouraged to look for alternate means to deliver their value offerings such as via the telephone and web-based technologies.
- Mobile-gaming (m-games) is one particular tool which is gaining popularity in social marketing. This mirrors the growth in the broader gaming and smartphone sectors. M-games are delivered using a mobile platform such as smartphones (e.g. Apple iPhone) and Tablets (e.g. iPads). The global m-gaming sector is expected to grow to \$100 billion by 2018,¹³ and in Australia 75% of people are likely to own a smartphone and 49% a tablet.¹⁴
- This growth has further attracted social marketers as they look for a tool which provides accessibility and value to not just the social or health cause, but to the consumer as well. Examples of m-games now being employed in the social marketing space include *Quit for You Quit for Two*, *My QuitBuddy* and *Dumb Ways to Die*.

Technologies such as telephone and web-based applications provide significant benefits as shown in Figure 4 (over).

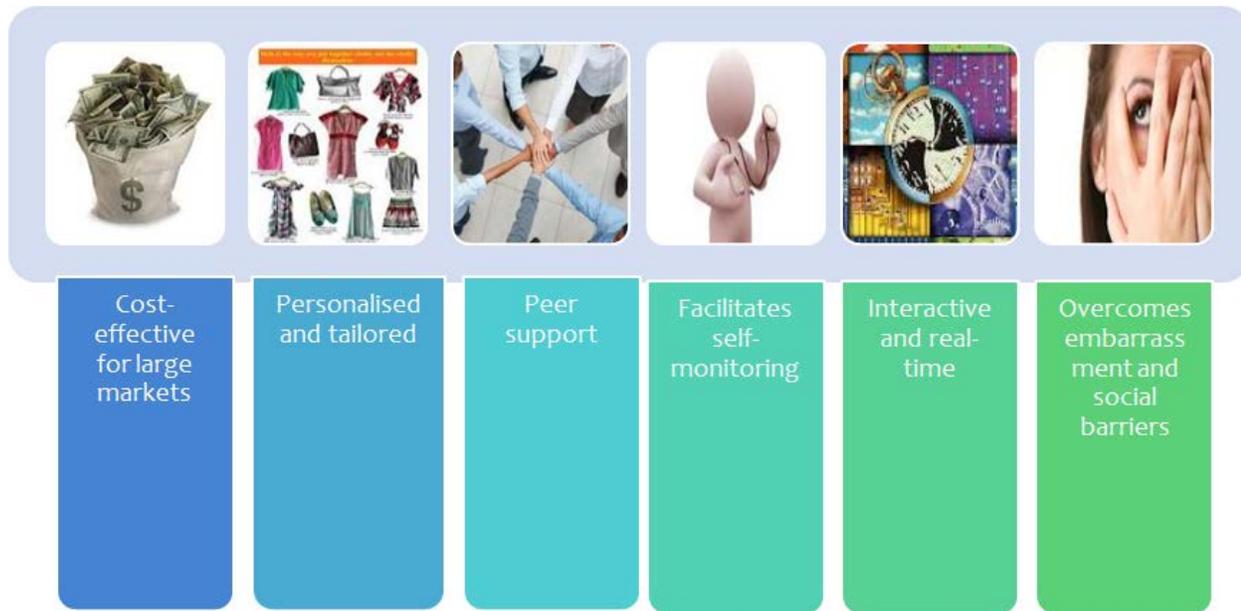
¹² Luca, N. R., & Suggs, L. S. (2010). Strategies for the social marketing mix: a systematic review. *Social Marketing Quarterly*, 16(4), 122-149.

¹³ Brightman, J. (2014). Games software market to hit \$100 by 2018. Retrieved 8/10/2014, from

<http://www.gamesindustry.biz/articles/2014-06-25-game-software-market-to-hit-usd100-billion-by-2018-dfc>

¹⁴ <http://www.news.com.au/technology/gadgets/telstra-smartphone-and-tablet-index-reveals-australians-are-addicted-to-smartphones/story-fn6vihic-1227078120633>

Figure 4. Benefits of using telephone and web-based interventions for personal health



Another approach to using technology is gamification which is the use of game elements in non-game settings. Examples of gamification in the fitness and nutrition domain include:

- Wii Fit (exercise training software with game elements)
- Nike+ (a tool used to increase users' motivation to jog¹⁵).

A number of recent studies have shown the benefits of gamification for physical and mental health and wellbeing.¹⁶ Reviews of the existing research confirm that gamification provides positive effects, with the caveats that consideration must be given to the context of users and the characteristics of the target users—issues that would obviously be key to consider in this space. In designing an effective intervention all elements need to motivate, engage and persuade in a way that is fit for purpose, suited to the target behaviour and appealing to target users. Work conducted by Daniel Johnson highlights both the benefits of approaches like gamification¹⁷ as well as identifying design constraints that need to be considered to maximise benefit.¹⁸

¹⁵ <http://www.learndash.com/successful-gamification-case-studies/>

¹⁶ Vella, K., Johnson, D., & Hides, L.M. (2013). Positively playful: When videogames lead to player wellbeing, *Gamification 2013: Proceedings of the First International Conference on Gameful Design, Research, and Applications*, pp. 99-102.

¹⁷ R.A. Calvo, D. Peters, D. Johnson, & Y. Rogers. (2014). *Autonomy in technology design*. In *CHI'14 Extended Abstracts on Human Factors in Computing Systems*. ACM.

Z. Fitz-Walter, P. Wyeth, D. Tjondronegoro, & D. Johnson. (2014). Exploring the effect of achievements on students attending university orientation. In *Proceedings of the first ACM SIGCHI annual symposium on Computer-human interaction in play*. ACM.

¹⁸ G.R. White, J. Lee, D. Johnson, P. Wyeth, & P. Mirza-Babaei. (2015). Crossing Domains: Diverse Perspectives on Players. In *Proceedings of the 33rd Annual ACM Conference Extended Abstracts on Human Factors in Computing Systems*. ACM.

Evidence of the effectiveness of Social Marketing Telephone and Web-based Technologies

Effectiveness simply means that the technology has achieved the set objectives:

- for health promotion this means awareness, knowledge-generation, education or attitude-change
- for social marketing this means that behaviour change has occurred.

It is vital to establish a clear objective when deciding to use telephone or web-based technologies as this determines whether health promotion, social marketing or both should be used and how the outcome of effectiveness will be measured. A drawback of past interventions is the lack of measurement of behaviour, with many interventions measuring success in terms of awareness, likeability and attitude change. Why is this? Because measuring behaviour is difficult, takes time and costs more than a one-off survey.

Currently there is growing evidence of the effectiveness of technology in changing physical activity, nutrition and weight loss. A randomised control trial of a mobile health intervention¹⁹ found that the use of a smartphone app helped users:

- decrease their body weight by an average of 1.6kgs
- increase their physical activity by 35 minutes a day
- increase vegetable intake and decrease sugar beverage intake by 355mls a week.

Technologies can achieve the following changes in physical activity, nutrition and weight loss:

- weight loss of 7.5kg or 7.5% of baseline weight in 12 months²⁰
- increase in adherence to dietary prescription and diet recording²¹
- greater motivation for weight loss, diet adherence and physical activity
- reduction in sugar-sweetened beverage consumption
- increase in muscular fitness strength and resistance training skills.²²

One further study by Carter et al.²³ compared the effectiveness of smartphone apps, websites and paper and pen diaries on influencing weight loss. Their study found that weight loss was significantly higher in smartphone app users than those using websites and paper diaries. Further, the reduction in body mass index (BMI) and body % fat change was considerably greater in 6 months compared to the website and paper and pen diary group. Therefore, it appears that smartphone apps maybe the most effective method for changing behavioural issues such as physical activity, nutrition and weight loss.

¹⁹ Hedben, L. et al. (2014). A mobile health intervention for weight management among young adults: a pilot randomised controlled trial. *Journal of Human Nutrition and Dietetics*, 27, 322-332.

²⁰ Khaylis, A., Yiaslas, T., Bergstrom, J. & Gore-Felton, C. (2010). A review of efficacious technology-based weight-loss interventions: five key components. *Telemedicine and e-Health*, 16, 931-938.

²¹ Carter, M. C., Burley, V. J., Nykjaer, C., & Cade, J. E. (2013). Adherence to a smartphone application for weight loss compared to website and paper diary: Pilot randomized controlled trial. *Journal of Medical Internet Research*, 15(4).

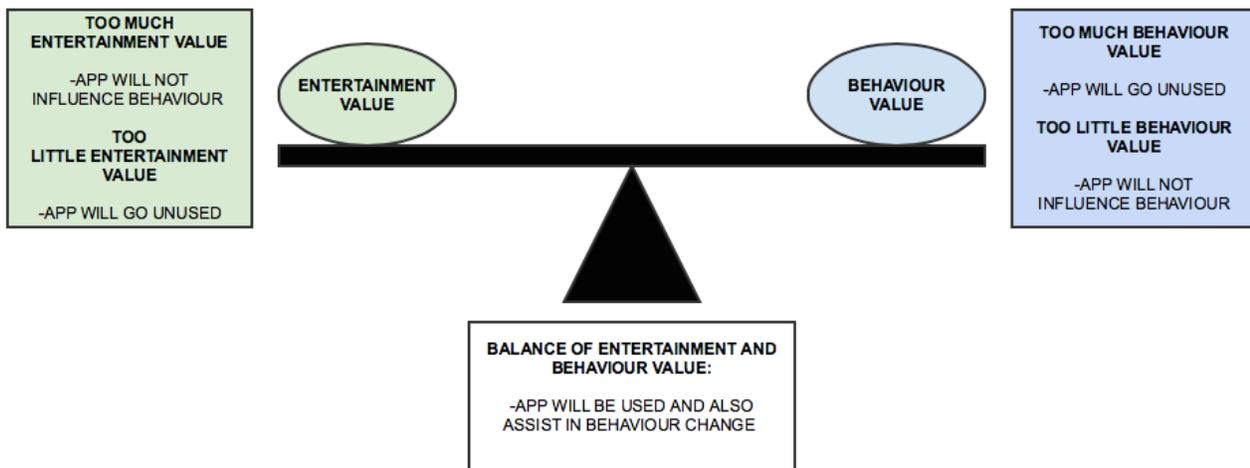
²² Smith, et al. (2014). Smart-phone obesity prevention trial for adolescent boys in low income communities: The ATLAS RCT. *Pediatrics*, 134(3), 723-731.

²³ Carter, M. C., Burley, V. J., Nykjaer, C., & Cade, J. E. (2013). Adherence to a smartphone application for weight loss compared to website and paper diary: Pilot randomized controlled trial. *Journal of Medical Internet Research*, 15(4).

How does technology change health behaviours?

So what makes a telephone or web-based technology effective in changing behaviours such as healthy eating, smoking or safety? A recent PhD study by one of the authors, Rory Mulcahy, has identified that balancing the entertainment aspects with those focused on behaviour is important, not only in motivating the user to use the app but also in having features which assist the user to change their behaviour.^{24,25} Without this balance of entertainment and behaviour-focused aspects telephone or web-based technology focused on behaviour change runs the risk of being: (1) not entertaining enough, or (2) too focused on behaviour. This balancing act is shown in Figure 5.

Figure 5. The balancing act of entertainment and performance to achieve behaviour change²⁶



²⁴ Mulcahy, R., Russell-Bennett, R. & Kuhn, K. (2014). *Mobile Games as an Agent of Change: Exploring Experiential Value in Social Marketing m-games*, ANZMAC conference at Griffith University, Southbank Campus.

²⁵ Mulcahy, R. (2015). *Disguising the Performance of Social Marketing M-games*. World Social Marketing Conference Sydney 2015 (Best Student Paper)

²⁶ Mulcahy, R. (2015). *Disguising the Performance of Social Marketing M-games*. World Social Marketing Conference Sydney 2015 (Best Student Paper)

Why don't some telephone and web-based personal health interventions work?

1. Lack of benefits for the user

Two of the authors, Rory Mulcahy and Professor Rebekah Russell-Bennett, and a colleague from Griffith University evaluated the online game component of the federal government's *Don't Turn a Night Out into a Nightmare* campaign.

Campaign overview:

- **Aim:** To identify if the game could effectively influence the behavioural intentions of young adults to drink in moderation.²⁷
- **Results:** The website game provided very little customer value to players and this led to low intentions to drink moderately in the future. Feedback from players indicated the game was too 'preachy' and unrealistic.

This example shows us that when technology is used for the purposes of changing behaviour it must provide high levels of customer value to effectively change the behaviour of the user.

2. Objectives that are attitude/awareness-focused rather than behavioural

The *Don't Turn a Night Out into a Nightmare* campaign had three objectives:

- (1) Raise awareness of the harms and costs associated with drinking to intoxication.
- (2) Deliver personally-relevant messages to encourage, motivate and support the primary target groups to assess their own drinking behaviour and reduce their drinking if needed.
- (3) Deliver personally-relevant messages to encourage, motivate and support the second target group (parents of 16-34 year olds) to assess their drinking attitudes and behaviours.

However, there was no objective which measured the effectiveness of campaign elements, in particular the website, or any objectives about behaviour change such as reducing risky-drinking behaviour/intentions.

3. Lack of accuracy and legitimacy in information provided

One particular issue with current smartphone apps and technology tackling health issues such as physical activity, weight loss and nutrition is the lack of legitimacy of the information as well as its accuracy or personalisation for the user.²⁸ Having legitimacy and personalised information for users has shown to be one of the most important key design factors in technologies attempting to change behaviour. This can be

²⁷ Mulcahy, R., Russell-Bennett, R. & Rundle-Thiele, S. (2015). Electronic Games: Can they create value for the moderate drinking brand? *Journal of Social Marketing* (In Press).

²⁸ Direito, A., Dale, L. P., Shields, E., Dobson, R., Whittaker, R., & Maddison, R. (2014). Do physical activity and dietary smartphone applications incorporate evidence-based behaviour change techniques? *BMC Public Health*, 14(1), 646.

attributed to a saturation of messages which contradict each other or are not appropriate for that particular individual.²⁹

However, adding legitimacy to technology and the messages is difficult as a user's preference or acceptance of messages is dependent on the source, whether that be a government body, commercial organisation or non-profit organisation. Such an approach was taken by the CityGT smartphone game app which avoided government branding.³⁰ Therefore, at times, it is appropriate to build a new brand which avoids government branding but at the same time reflects legitimacy and relates to the user.

4. Lack of appropriate behaviour change techniques or features

When planning technologies that change behaviour research has shown the value of using a theoretical foundation to guide their design. Indeed there is a growing body of evidence of a positive association between the inclusion of theory-based behaviour change techniques and features in technology, such as smartphone apps, and the achievement of actual behaviour change.³¹ However, currently in practice the majority of technologies in the market tackling physical activity, weight loss and nutrition are lacking in theory-driven behaviour change techniques or features.³² Therefore, an important consideration prior to constructing any form of technology to change behaviour is the selection of a theory as well as a behaviour change technique(s) and features framework to guide the design and build process.

5. Costs perceived by user as too high

People do not seem to want to pay for technology that has a goal other than entertainment. If the main purpose of the technology is to lose weight, eat better, drink less, quit smoking or other personal health goals there is a general resistance to adopting paid technology. Unfortunately the development costs of truly effective technologies may require some investment to ensure financial viability and typically the most effective technology generally costs the user.

²⁹ Schoffman, D. E., Turner-McGrievy, G., Jones, S. J., & Wilcox, S. (2013). Mobile apps for paediatric obesity prevention and treatment, healthy eating, and physical activity promotion: Just fun and games? *Translational Behavioral Medicine*, 3(3), 320-325.

³⁰ Tierney, P. (2011). It sounds counterintuitive, but can mobile phones be used to reduce driver distraction? *Journal of the Australasian College of Road Safety*, 22(4), 94.

³¹ Cowan, L. T., Van Wagenen, S. A., Brown, B. A., Hedin, R. J., Seino-Stephan, Y., Hall, P. C., & West, J. H. (2012). Apps of steel: Are exercise apps providing consumers with realistic expectations? A content analysis of exercise apps for presence of behavior change theory. *Health Education & Behavior*, 1090198112452126.

³² Conroy, D. E., Yang, C. H., & Maher, J. P. (2014). Behavior change techniques in top-ranked mobile apps for physical activity. *American Journal of Preventive Medicine*, 46(6), 649-652.

Critical success factors

When using a social marketing approach to design telephone and web-based technologies for personal health government will have a better chance of influencing people to adopt a behaviour if:³³

1. They have detailed knowledge about a target market's lifestyle, thoughts and feelings (consumer orientation).
2. Recognise that not all people are prepared to change (segmentation).
3. Consider how other behaviours and existing preferences will compete with the social change proposition (competition).
4. Make it desirable and easy for people (value exchange, marketing mix).
5. Partner with influential people (place).
6. Communicate effectively (promotion).
7. Are in it for the long run (sustainability).

Recommendations for success

We recommend the following key factors in order for a telephone or web-based personal health intervention to be effective.

A comprehensive systems approach—involve other areas of government

The use of telephone and web-based technologies should not be an isolated campaign; rather this needs to be part of a broader strategy at a whole-of-government or whole-of-department level. The technologies need to complement the other approaches of education and policy/law and sit alongside service delivery. The technologies will only be effective when there is a systems approach—a point also identified in the 2011 UK House of Lords inquiry³⁴. This means the technologies must not be an isolated campaign that is developed by communications experts, otherwise they run the risk of being disconnected from the macro-level influences on people's behaviours such as community and social norms, policies, service delivery and legislation. An isolated campaign also places the responsibility on the individual which ignores the complexity of the factors that actually influence health behaviours. Telephone and webbased interventions must be incorporated in a broader strategy set by multi-disciplinary team of policymakers, marketing experts (who use more than communications), health promotion experts and frontline health service providers. The technology must link to other services provided by the Queensland government (even those beyond health such as family and community services, education and possibly parks and wildlife), advertising, legislation, policies and community groups to be effective.

Longevity—beyond the political cycle and involve non-profit organisations

Many interventions are limited to being short-term by the nature of the political cycle. For an intervention that is aimed at changing complex behaviour, such as healthy eating, exercise and weight loss, a political

³³ Lagarde, F. (2011). Insightful social marketing leadership. *Social Marketing Quarterly*, 18(1), 77-81.

³⁴ <http://www.parliament.uk/business/committees/committees-a-z/lords-select/science-and-technology-committee/news/behaviour-change-published/>

cycle of 2-3 years is not sufficient. Programs need to be funded for a longer period of time and involve non-profit organisations that are able to work at arm's-length from the political machine.

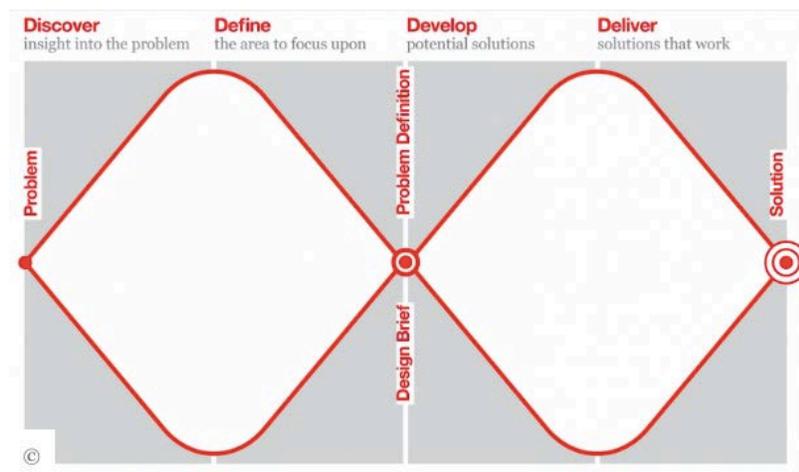
Behaviour focus—not just attitudes and awareness

One of the biggest drawbacks of a health promotion approach is the reliance on communication and media, which has at its heart attitude change and knowledge generation. While these are vital first steps in any behaviour change program they are often also the end-point for well-intentioned government campaigns that do not end up with behaviour change. In a current systematic review of publications regarding tools that use gamification as a means to motivate people to engage in health-related behaviour change (currently being undertaken by Daniel Johnson and colleagues) a very low proportion were found to empirically evaluate actual changes in behaviour. Instead the majority focused on subjective ratings of the tools and failed to properly isolate actual impact.

Use a design approach

One of the authors, Professor Marcus Foth and his research team, uses *design thinking* to bring a unique quality to approaching behaviour change challenges. Although this term has been used in vague and ambiguous ways in popular press, the rigour and merits of a research approach guided by design thinking is usually characterised by three aspects. Employing the Double Diamond approach³⁵ (see Figure 6) the research team does not delve into development and delivery straight away following a tender call or a project brief; instead, it first undertakes two phases of discovery and refinement, which may lead to a collaborative re-definition of the project brief.

Figure 6: Double Diamond approach (source: <http://www.designcouncil.org.uk/news-opinion/design-process-what-double-diamond>)



Second, people come first, which is translated into a human-centred design approach that follows iterative cycles of observation, ideation, prototyping and testing.

Third, design thinking also requires a certain type of research culture and sensitivity, which entails emphasising in situ and empathetic people observations (rather than questionnaires and focus groups),

³⁵ <http://www.designcouncil.org.uk/news-opinion/design-process-what-double-diamond>

action research, participatory design and experimentation, and critical and collaborative evaluations and refinements. Although aspects of design thinking are being implemented and applied under different names in many other disciplines it is the design research community that has established this combined approach, what Norman (2013) calls 'a systematic, practice-defining method of creative innovation. It is intended to be the normal way of proceeding, not the exception.'³⁶

Framework for design—a theory-led approach

A notable feature in the design of technology for effective behaviour change is the presence of a theoretical framework to inform the design and development of the intervention. Research into the design of smartphones for weight loss and nutrition found that the greater the number of theoretical design features (such as goal setting, feedback, self-monitoring and dietary journals) the more likely the intervention would be effective.³⁷ Professor Judy Drennan and her research team used the Model of Goal Directed Behavior³⁸ in developing a mobile phone app intervention for moderate drinking behaviour targeted at young women (GurlsNiteOut).^{39,40} Additionally, social marketing research has provided a list of design features which are required for an app to be effective in entertaining the user but also in assisting them to change their behaviour.⁴¹

1. Challenge
2. Character (not always applicable to all apps)
3. Feedback
4. Virtual training
5. Behaviour monitoring

Customer-focus — let the user lead the way

Key components of communicating effectively include delivering information in a way that is engaging and (where appropriate) fun, while still taking account of the context of use and the target users. Gamification offers a means to achieve these goals and there is support for gamification as a means to improve motivation through digital tools. However, some kinds of gamification (for example simple rewards, point systems, badges etc.) are useful for short-term goals (e.g., on-boarding or adoption), but it may be that they are less useful in the long-term and where the goal is to create deeper engagement with the content area. Meaningful engagement and long-term motivation is more likely to result through the use of other types of

³⁶ <http://www.core77.com/posts/24579/Rethinking-Design-Thinking>

³⁷ Direito, A., Dale, L. P., Shields, E., Dobson, R., Whittaker, R., & Maddison, R. (2014). Do physical activity and dietary smartphone applications incorporate evidence-based behaviour change techniques? *BMC Public Health*, 14(1), 646.

³⁸ Perugini, M. & Bagozzi, R. P. (2001). The role of desires and anticipated emotions in goal-directed behaviours: Broadening and deepening the theory of planned behaviour. *British Journal of Social Psychology*, 40, 79–98. doi: 10.1348/014466601164704

³⁹ Fry, M-L., Drennan, J., Previte, Josephine, White, A., & Tjondronegoro, D. (2014). The role of desire in understanding intentions to drink responsibly: An application of the model of goal-directed behaviour. *Journal of Marketing Management*, 30(5-6), 551-570.

⁴⁰ Previte, J., Fry M-L., Drennan J. & Fazal-e-Hasan, S. (2015) Friends or foes: Group influence effects on moderate drinking behaviours. *Journal of Business Research*. doi:10.1016/j.jbusres.2015.03.014

⁴¹ Mulcahy, R. (2015). *Disguising the Performance of Social Marketing M-games*. World Social Marketing Conference Sydney 2015 (Best Student Paper)

gamification, such as incorporating play in the form of freedom to explore within boundaries, building in exposition in terms of stories that are integrated with real-world settings, giving players choice within the system, providing information using game design and display concepts, engaging players with others interested in the real-world setting and helping players to reflect.⁴²

Effective evaluation methods—appropriate, scientific and evidence-based

One of the benefits of a theory-based approach is the connection to rigorous, scientific evaluation. Social marketing programs that have substantial evaluation and that are well-resourced provide an evidence-base for programs. Too many health promotion and social marketing programs are under-funded, leaving little money available to determine whether the program worked and if so/not why. The need for scientific rigour AND appropriate evaluation at both the process and outcome stages was a key feature of the House of Lords inquiry into behaviour change and a factor that needs to be strongly supported in this inquiry’s report. Ensuring rigorous and scientific evaluation can determine the performance (the success or failure) of a technology attempting to change behaviours of individuals.

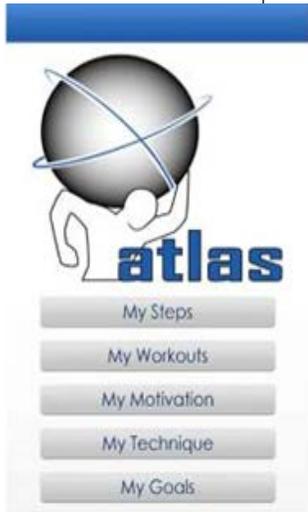
An example of rigorous and scientific approaches to evaluating the performance of technology in tackling physical activity, nutrition and weight loss can be seen in the ATLAS program⁴³ (evaluated by the University of Newcastle), which used a randomised control trial in order to pinpoint the effectiveness of the smartphone app in behaviour change. A series of focus groups were also conducted to gain insight into participants’ experiences in, and perceptions of, the ATLAS program and the smartphone app. Using such approaches to evaluate a technology’s effectiveness in changing behaviour is advantageous as this allows for learnings from ‘best practice’, as well as learnings for improvement in the development of technology and programs.

ATLAS

(Active Teen Leaders Avoiding Screen Time)

- **Aim:** Targeted at low-income high schools boys with the aim of increasing their physical activity and reducing time on television and video games.
- **Solution:** Purpose-built smartphone app and website with features including goal setting, self-monitoring, diary of sugary drink and food consumption and assessment of fitness goals.
- **Outcome:** Significant effects were found in the reduction of television and video game use, sugar-sweetened beverage consumption. Increases found in muscular fitness and resistance training skills.

University of Newcastle



⁴² Phillips, C., Johnson, D., & Wyeth, P. (2013). Videogame reward Types. In *Proceedings of the First International Conference on Gameful Design, Research, and Applications*. ACM.

Nicholson, S. (2014). A RECIPE for Meaningful Gamification. To be published in Wood, L & Reiners, T., eds. *Gamification in Education and Business*, New York: Springer. Available online at <http://scottnicholson.com/pubs/recipepreprint.pdf>

⁴³ Lubans, D. R., Smith, J. J., Skinner, G., & Morgan, P. J. (2014). Development and implementation of a smartphone application to promote physical activity and reduce screen-time in adolescent boys. *Frontiers in Public Health*, 2.

Appendix – Effectiveness of Apps in Achieving Weight Loss, Dietary and Physical Activity Change

| Technology | Country | Research Methodology & Intervention Design | Outcome/Findings | Author & Year |
|-------------------------------------|-----------|--|---|--------------------------|
| Weight Loss and Diet Control | | | | |
| Smartphone App | Australia | <p>Sample: 58 adult women</p> <p>Research Design: 8-week trial</p> <p>The intervention group received an MRP app. The control group received an app that reproduced the information available with the MRP.</p> <p>The study comprised two phases: during the first four weeks meal replacements were provided to participants (feasibility phase), and during the second four weeks participants were required to purchase their own meal replacements if they wished to continue on the diet (free-living phase)</p> | <ul style="list-style-type: none"> • Users of the support app were more engaged than those using the control app • Women in the intervention group reported a greater increase in positive affect (i.e. mood) than those in the control group • The control group reported a greater decrease in the effort they were willing to put into staying on the diet than those who received the support app • Both groups lost weight during the study period • The pooled difference in weight loss between the groups favoured the intervention group | Brindal et al. (2013) |
| Website & App | Australia | <p>Evaluation of <i>Healthier. Happier</i> Campaign</p> <p>Queensland Health campaign</p> | <ul style="list-style-type: none"> • Over 460,000 unique visitors to the website with an average of 4.09 page views • The Health & Fitness Age calculator has been completed over 409,000 times • The Health & Fitness Age Challenge App has been downloaded over 84,000 times • 61% prompted recall of the campaign • 48% reported that they had started exercising more and eating more fruit and vegetables • 39% reported that they started to drink less alcohol • 35% reported that they started to drink less sugary drinks | Martin (2015) |
| Website | USA | <p>Sample: n=123</p> <p>Research Design: participants took part in a 12-month behavioural weight control program over the Internet and their website utilisation patterns were monitored.</p> | <ul style="list-style-type: none"> • ‘Feedback’ factor (progress charts, physiological calculators, and past journals) was the best predictor of weight loss during the treatment period (baseline to 6 months) • ‘Social support’ factor (web chats and biographical information/e-mail addresses of participants) was the best predictor during maintenance | Krukowski et al., (2008) |

| Technology | Country | Research Methodology & Intervention Design | Outcome/Findings | Author & Year |
|---------------------------------------|---------|--|--|-------------------------------|
| | | | <ul style="list-style-type: none"> Weight loss in an online weight control program was related to dynamic web features that provided feedback, support and motivation to participants Participants lost an average of 7.5kg or 7.5% of baseline weight in 12 months | |
| Smartphone App & Podcasts | USA | <p>Sample: n=96 overweight adults</p> <p>Research Design: Experimental Design, randomly assigned to Podcast-only or Podcast+Mobile groups</p> <p>Groups received 2 podcasts per week for 3 months and 2 minipodcasts per week for months 3–6. The Podcast+Mobile group were asked to use a diet and physical activity monitoring application (app) on their mobile device, interact with study counsellors and other participants on Twitter</p> <p>The objective of the study was to examine whether a combination of podcasting, mobile support communication, and mobile diet monitoring can assist people in weight loss</p> | <ul style="list-style-type: none"> Weight loss did not differ by group at 6 months Days/week of reported diet monitoring did not differ between Podcast+Mobile and Podcast groups Podcast+Mobile participants were 3.5 times more likely than the Podcast group to use an app to monitor diet, whereas the majority of Podcast participants reported using the web or paper More downloads per episode in the Podcast+Mobile group than in the Podcast group More Podcast participants relied on friends, whereas Podcast+Mobile participants relied on online sources Mobile POD, 6-month, minimal-contact intervention was effective at helping participants achieve a mean weight loss of 2.7% of their body weight, and perhaps was useful in preventing holiday weight gain | Turner-McGrievy et al. (2011) |
| Smartphone App, Website & Paper Diary | UK | <p>Sample: 128 overweight volunteers</p> <p>Research Design: Experimental Design (weight management intervention delivered by smartphone app, website, or paper diary)</p> | <ul style="list-style-type: none"> Adherence was statistically significantly higher in the smartphone group with a mean of 92 days (SD 67) of dietary recording compared with 35 days (SD 44) in the website group and 29 days (SD 39) in the diary group (P<.001) BMI change in 6 months was larger in the smartphone group Change in body fat percentage was also higher in the smartphone group | Carter, et al. (2013) |
| Smartphone Apps | UK | <p>Sample: 19 students and staff at a university in the United Kingdom. Participants included 13 females and 6 males with a mean age of 23.79 (SD 7.89)</p> <p>Research Design: Focus Group</p> | <ul style="list-style-type: none"> Study findings suggested that young, currently healthy adults have some interest in apps that attempt to support health-related behaviour change Accuracy and legitimacy, security, effort required, and immediate effects on mood emerged as important influences on app usage The ability to record and track behaviour and goals, and the | Dennison, et al. (2013) |

| Technology | Country | Research Methodology & Intervention Design | Outcome/Findings | Author & Year |
|--|---------------|--|---|--------------------------------|
| | | | <p>ability to acquire advice and information ‘on the go’ were valued</p> <ul style="list-style-type: none"> Context-sensing capabilities and social media features tended to be considered unnecessary and off-putting | |
| Weight Loss & Physical Activity | | | | |
| Smartphone App & Podcasts | USA | <p>Sample: 96 overweight men and women</p> <p>Research Design: 6-month randomised trial All participants received a behavioural weight loss intervention delivered via podcast and were encouraged to self-monitor dietary intake and physical activity</p> <p>The purpose of the study was to assess the relationship between diet (mobile app, website, or paper journal) and physical activity (mobile app vs no mobile app) self-monitoring and dietary and physical activity behaviours</p> | <ul style="list-style-type: none"> Physical activity app users self-monitored exercise more frequently over the 6-month study and reported greater intentional physical activity than non-app users Self-monitoring did not differ by app or non-app users App users consumed less calories than paper journal users at 6 months BMI did not differ among the three diet monitoring methods | Turner-McGrievy, et al. (2013) |
| Smartphone App | Australia | <p>Sample: n=51</p> <p>Research Design: University students and staff aged 18–35 years were randomised (ratio 1 : 1, intervention : control)</p> <p>Both groups received a printed diet booklet with instructions prepared by a dietician. The intervention group also received SMS text messages (four per week), e-mails (four per week), and had access to smartphone applications and Internet forums</p> | <ul style="list-style-type: none"> Participants in the intervention group: <ul style="list-style-type: none"> Decreased their body weight by a mean of -1.6kgs Increased physical activity by 35 minutes a day Increased vegetable intake 1.0 median serving a day Decreased sugar-sweetened beverage intake -355ml a week | Hebden, et al. (2014) |
| Gaming Console | Not specified | <p>Sample: n=15 first time Wii Fit users</p> <p>Research Design: Month-long study with participants using Wii Fit system. Data was collected via in-home observations and interviews at the beginning and end of the</p> | <ul style="list-style-type: none"> Beginners expressed positive sentiments about the system and its ability to motivate them to engage in fitness activities Non-beginners had entirely different experiences with Wii Fit and were ultimately dissatisfied with the system as a fitness tool; non-beginners often disliked the content of the feedback they received, as gamified feedback such as scores and stars weren’t as helpful for these users | Reynolds et al. (2013) |

| Technology | Country | Research Methodology & Intervention Design | Outcome/Findings | Author & Year |
|--------------------------|-----------|---|---|----------------------------|
| | | <p>month.</p> <p>Two groups of participants: Beginners and non-beginners</p> | <ul style="list-style-type: none"> A challenge for the design of gamified persuasive systems is that the content of feedback desired by users changes as they acquire experience and self-efficacy regarding the target behaviour | |
| Smartphone App & Website | Australia | <p>Sample: n=361</p> <p>Research Design: Cluster randomised controlled trial with 361 boys in 14 secondary schools</p> | <ul style="list-style-type: none"> The majority of participants (70%) reported using the goal setting function to increase their physical activity or reduce their screen-time Almost half of the group agreed or strongly agreed that the push prompt messages reminded them to be more active, reduce their screen-time, and drink less sugary drink 95% of participants agreed or strongly agreed that the program overall was enjoyable Participants' intentions to limit their recreational screen-time, limit their consumption of sugary drinks, participate in regular physical activity, and muscle strengthening activities were high following the completion of the program | Lubans et al. (2014) |
| Smartphone App & Website | Norway | <p>Sample: n=21</p> <p>Research Design: Randomised control trial Both groups reported physical activity using daily report forms in four registration weeks during the three-month study: only the experiment condition received access to the intervention</p> | <ul style="list-style-type: none"> Intervention group had significantly more minutes of physical activity in weeks five and nine By week 12 the difference between the two groups was no longer significant | Thorsteinsen et al. (2014) |
| Smartphone App | USA | <p>Sample: n=23</p> <p>Research Design: Focus Group Discussion</p> | <ul style="list-style-type: none"> Design features include: goal setting, rewards, self-monitoring and sharing On average, each participant set 3.8 primary goals and 2.3 secondary goals during the four full weeks of the study Participants achieved 58% of each primary goal Reminders were effective at helping participants stick to their exercise goals 17 of the 23 elected to continue using the app | Munson and Consolvo (2012) |

Design Factors for Effective Weight Loss, Physical Activity & Diet Apps

| Country | Technology Platform/Behaviour | Methodology | Outcomes/Discussion/Findings | Author /Year |
|-------------|--|--|---|-----------------------|
| New Zealand | Smartphone Apps/Physical Activity and Diet | <p>Sample: Top 20 paid and top 20 unpaid smartphone apps from New Zealand App Store Health & Fitness category</p> <p>Research Design: The taxonomy of behaviour change techniques (BCTs) (26 in total) was used to assess apps.</p> | <ul style="list-style-type: none"> • Apps had an average of 8.1 BCTs • Most frequently included BCTs were: 'provide instruction' (83% of the apps), 'set graded tasks' (70%), and 'prompt self-monitoring' (60%) • BCTs such as such as 'teach to use prompts/cues', 'agree on behavioural contract', 'relapse prevention' and 'time management' were not present in the apps reviewed • BCTs associated with increased intervention effectiveness were in general more common in paid apps | Direito et al. (2014) |
| America | Smartphone Apps/Pain Relief & Maintenance | <p>Sample: 222 pain-related smartphone apps available for Android and Apple (study currently in the process of being published)</p> | <ul style="list-style-type: none"> • BCTs included pain diaries to therapeutic advice for pain sufferers • Therapeutic when patients feel they have access to their physicians • Mobile apps 'appear to offer us a connection with patients that we never had before' • The lead researcher of the study says apps have the potential for improving pain management, but stricter oversight is needed | Dolan (2013) |
| N/A | Smartphone Apps/Physical Activity | <p>Sample: 167 top ranked apps</p> <p>Research Design: Coded apps according to Coventry, Aberdeen and London-Revised (CALO-RE) taxonomy of behaviour change techniques (BCTs)</p> | <ul style="list-style-type: none"> • Most descriptions of apps incorporated fewer than four BCTs • The most common techniques involved providing instruction on how to perform exercises, modelling how to perform exercises, providing feedback on performance, goal-setting for physical activity, and planning social support/change • A latent class analysis revealed the existence of two types of apps, educational and motivational, based on their configurations of BCTs | Conroy et al. (2014) |
| UK | Smartphone Apps/Alcohol Consumption | <p>Sample: 662 apps focused on alcohol consumption</p> <p>Research Design: Search terms in app stores were 'alcohol' and 'drink'</p> <p>Theory was coded if the app made reference to specific psychological theory. Evidence was coded if the app made reference to empirical evidence.</p> | <ul style="list-style-type: none"> • The average number of BCTs used was 3.56 • The most frequently used BCTs were: 'facilitate self-recording' (54%), 'provide information on consequences of excessive alcohol use' (42%), and 'provide feedback on performance' (41%) • 'Prompt review of goals' was positively associated with user ratings in univariate regression models; no other significant associations between BCTs and user ratings were found • Apps that advised on environmental restructuring (e.g. avoiding situations where drinking is involved) had lower user ratings • Both 'advise on/facilitate the use of social support' and the mention of evidence were positively associated with popularity | Crane (2015) |

| Country | Technology Platform/Behaviour | Methodology | Outcomes/Discussion/Findings | Author /Year |
|---------------|---|--|--|--------------------------|
| UK and Canada | Smartphone Apps/Diet and Local Food Consumption | <p>Sample: Systematic literature review of smartphone app research papers (53 papers in total) to help design app SmartAPPetite Survey n=208 Follow up phone interview n=123</p> <p>Research Design: Mixed method (Literature review/Survey/Interviews)</p> | <ul style="list-style-type: none"> • SmartAPPetite's design was guided by Atkins and Michie's (2013) principles of individual behaviour change (capability, opportunity, motivation) • SmartAPPetite was effective at creating a sense of improved awareness and consumption of healthy foods, as well as drawing people to local food vendors with greater frequency • Direct suggestions to improve SmartAPPetite: 58% of participants wanted to see more messages about direct farmgate vendors • Involvement with SmartAPPetite had a direct effect on consumption of healthy foods • Participants were vocal about structuring delivery times so messaging did not arrive at inconvenient times, decreasing the volume of messages, spreading out the messages more evenly throughout the week | Gilliland, et al. (2015) |
| Not specified | Smartphone Apps/Physical Activity and Diet | <p>Sample: 57 apps for iPhone/iPad</p> <p>Research Design: Tested by two independent raters. Apps were coded for: inclusion of the Expert Committee for Pediatric Obesity Prevention's (ECPOP) eight recommended strategies (e.g., set goals) and seven behavioural targets (e.g., do 1 hour of exercise a day, utilisation of gaming elements, and general characteristics)</p> | <ul style="list-style-type: none"> • Most apps lacked any expert recommendations (n=35, 61.4%) • 56.1% (n=32) of apps were classified as games, and mean price per app was \$1.05 • Most apps reviewed lacked expert recommendations and could be strengthened by the addition of comprehensive information about health behaviour change and opportunities for goal setting | Schoffman, et al. (2013) |
| Not specified | Smartphone Apps/Physical Activity and Diet | <p>Sample: 30 weight-loss apps for iPhone and Android</p> <p>Research Design: Apps in the top 100 paid and top 100 free 'health and fitness' categories of iTunes and the Android Market were searched. Apps were evaluated according to the Diabetes Prevention Program. Themes included strategies such as weight-loss goals, dietary</p> | <ul style="list-style-type: none"> • The vast majority of apps included goal setting for weight loss (93.3%) and diet (90%) • Goal setting was typically accomplished by having users select a target goal weight and then providing a calorie-intake goal • 20% of mobile apps gave users a specific physical activity goal in terms of days or minutes per week • The two mobile apps that had the highest percentage of criteria met were MyNetDiary (free) and MyNetDiary Pro (paid) • Most common behavioural strategies in 30 popular weight-loss mobile apps were weight-loss goal setting, dietary goal setting, and calorie | Pagoto, et al. (2013) |

| Country | Technology Platform/Behavior | Methodology | Outcomes/Discussion/Findings | Author /Year |
|---------------|--|--|--|-----------------------|
| | | goals, lifestyle activity and social cues | balance | |
| Not specified | Smartphone Apps/Physical Activity and Diet | <p>Sample: 200 apps on iTunes store</p> <p>Research Design: Health and Fitness apps were evaluated using predetermined inclusion/exclusion criteria and categorised based on commonality in functionality, features, and developer description</p> <p>Four researchers then evaluated the two most popular apps in each category using two instruments: one based on traditional behavioural theory (score range: 0–100) and the other on the Fogg Behavioral Model (score range: 0–6)</p> | <ul style="list-style-type: none"> Eligible apps (n=23) were divided into five categories: (1) diet tracking, (2) healthy cooking, (3) weight/anthropometric tracking, (4) grocery decision making, and (5) restaurant decision making All apps were found to be very low in theoretic content or use of theory to guide behaviour change; mean behavioural theory score was 8.0; the mean persuasive technology score was 1.9 (SD=1.7). The top-rated app on both scales was Lose It! by Fitnow Inc | Azar, et al. (2013) |
| Not specified | Smartphone Apps/Physical Activity and Diet | <p>Sample: 204 apps on iTunes store</p> <p>Research Design: ANOVA used to measure variance of mean user ratings for apps</p> <p>Apps were also scored against 13 guidelines set by the Centers for Disease Control and Prevention, National Institutes of Health, the Food and Drug Administration, and the US Department of Agriculture</p> | <ul style="list-style-type: none"> Main finding was that a majority of these apps adhered to one to two evidence-informed practices. There were three main types: (1) Apps used for assessing weight (BMI) and tracking weight, (2) dietary journals or apps that offered dietary advice, and (3) weight assessment and tracking 23% were free, 69% cost between \$0.99 and \$4.99, and 8% cost between \$5.00 and \$19.99 | Breton, et al. (2011) |
| Not specified | Smartphone Apps/Physical Activity and Diet | <p>Sample: 127 apps iTunes store</p> <p>Research Design: Apps coded according to theories including: health belief model, the theory of reasoned action/planned behaviour, the transtheoretical model, and the social cognitive theory/social learning theory</p> <p>Further, 20 constructs for the four</p> | <ul style="list-style-type: none"> Apps were generally observed to be lacking in theoretical content Theory scores ranged from 1 to 28 on a 100-point scale Majority of apps (70%) were \$1.99 or less The health belief model was the most prevalent theory, accounting for 32% of all constructs Regression analyses indicated that higher priced apps and apps that addressed a broader activity spectrum were associated with higher total theory scores Theory was positively associated with number of exercise-related behaviours the app was designed to encourage | Cowan et al., (2012) |

| Country | Technology Platform/Behavior | Methodology | Outcomes/Discussion/Findings | Author /Year |
|---------------|------------------------------|--|--|-----------------------|
| | | behaviour change theories were used such as: self-efficacy, goal setting, stimulus control, social support, relapse prevention, and perceived barriers | | |
| Not specified | Technology-Based Weight Loss | <p>Sample: Systematic review of 21 studies</p> <p>Research Design: Qualitative review of studies</p> | <ul style="list-style-type: none"> • Identified the following five components that are considered to be crucial in technology-based weight-loss interventions that are successful in facilitating weight loss: <ol style="list-style-type: none"> 1. self-monitoring 2. counsellor feedback and communication 3. social support 4. use of a structured program 5. use of an individually tailored program | Khaylis et al. (2010) |

Diet and Exercise Campaigns Using Smartphone Apps

ATLAS (Active Teen Leaders Avoiding Screen-Time)—Developed by the University of Newcastle

Campaign/Project Overview:

The intervention was targeted at low-income high school boys with the aim of making an improvement in their fitness and a reduction in television and video game usage.⁴⁴ The intervention had a purpose-built smartphone app for physical activity monitoring, goal setting, assessment of resistance training techniques (such as squats and push-ups) and monitoring of sugary drink consumption.

App Development:

The ATLAS app development was guided by Self Determination Theory (SDT),⁴⁵ which focuses on the degree to which an individual's behaviour is self-motivated and self-determined.

Results:

1. No significant intervention effects for BMI, waist circumference, body fat percentage or physical activity.⁴⁶
2. Significant intervention effects were found for screen-time, sugar-sweetened beverage consumption, muscular fitness and resistance training skills.

⁴⁴ The University of Newcastle. (2015). Teen boys swap screens for fitness. Retrieved from: <https://www.newcastle.edu.au/newsroom/teen-boys-swap-screens-for-fitness>

⁴⁵ Lubans, D., Smith, J., Skinner, G. & Morgan, P. (2014). Development and implementation of a smartphone application to promote physical activity and reduce screen-time in adolescent boys. Retrieved from:

https://books.google.com.au/books?id=2LRQBQAAQBAJ&pg=PA107&lpg=PA107&dq=atlas+uni+of+newcastle+smartphone+app&source=bl&ots=mngpLV9Aso4&sig=L5c1B9_n6Xjk0cy7A4V7xqoPMFw&hl=en&sa=X&ei=ZW48Vem8LcTFmQW1_4DgDw&ved=0CDwQ6AEwBQ#v=onepage&q=atlas%20uni%20of%20newcastle%20smartphone%20app&f=false

⁴⁶ Smith, et al. (2014). Smart-phone obesity prevention trial for adolescent boys in low income communities: The ATLAS RCT. *Pediatrics*, 134(3), 723-731.

FODMAP—Developed by Monash University

Campaign/Project Overview:

FODMAP (fermentable, oligosaccharides, disaccharides, monosaccharides and polyols) was designed to help adult sufferers of irritable bowel syndrome improve their diet. The app was launched on iPhone in December 2012 and on Android in November 2013.⁴⁷

App Overview:⁴⁸

- 1. Food guide section:** Lists eight major factor categories: (1) beverages; (2) cereals; (3) condiments; (4) dairy; (5) fruit; (6) meat, fish and eggs; (7) pulses, tofu and nuts; and (8) vegetables
- 2. Recipes:** The recipe section contains over 79 breakfast, lunch, dinner and snack ideas which are low FODMAP
- 3. Week Challenge:** Users can monitor their diet and improve and challenge themselves to improve each week

⁴⁷ Monash University. (2015). The Monash University Low FODMAP Diet app. Retrieved from: <http://www.med.monash.edu.au/cecs/gastro/fodmap/iphone-app.html>

⁴⁸ Monash University. (2012). The Monash University Low FODMAP diet – User Guide. Retrieved from: <http://www.med.monash.edu.au/cecs/gastro/fodmap/docs/user-guide.pdf>

Better Health Channel Health Information and Services—Developed by Department of Health (Victoria)

Campaign/Project Overview:⁴⁹ The Better Health Channel (BHC) provides health and medical information that is quality assured, reliable, up-to-date, easy to understand, regularly reviewed and locally relevant. BHC does not have any advertising or sponsorship and is fully funded by the State Government of Victoria (Australia).

App Overview:⁵⁰

1. Health information articles, including topics such as healthy living, relationships and family
2. First aid procedures for common injuries (such as bites, burns heat stroke and hypothermia)
3. Healthy and nutritious recipes
4. Customised shopping list
5. Suburb and postcode discovery for health providers such as doctors, dentists, pharmacists and physiotherapists
6. Urgent medical help and advice contacts including Nurse On Call, Kids helpline, Poisons Information, Lifeline and more
7. Personalised health alerts and notifications for heat, temperature, UV, smog and pollen

⁴⁹ State Government of Victoria. (2015). Better Health Channel, About Us. Retrieved from: http://www.betterhealth.vic.gov.au/bhcv2/bhcsite.nsf/pages/bhc_aboutus?open

⁵⁰ Better Health Channel. (2015). Better Health Channel – Health Information and Services. Retrieved from: <https://itunes.apple.com/au/app/id463383478?mt=8>