Digital Health Research Review™

Making Education Easy

In this issue:

Welcome to our first issue of Digital Health Research Review.

This review is a unique New Zealand publication providing topical, relevant and accessible information on the exciting and innovative area of digital health technology. The review brings you up-to-date studies on applications (apps) and other platforms designed to improve health outcomes.

We hope you find our inaugural selection for Digital Health Research Review stimulating reading and we welcome your feedback. Furthermore, if you have discovered or been involved with what you think is significant global research in this area, please let us know and we will consider it for inclusion next time.

I would like to thank Professor Chris Bullen, Rosie Dobson and Gayl Humphrey for their contribution to our inaugural issue of this review.

Kind regards,

Dr Robyn Whittaker
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Efficacy of mobile apps to support the care of patients with diabetes mellitus: A systematic review and meta-analysis of randomized controlled trials

Authors: Bonoto BC et al.

Summary: This meta-analysis evaluated the use of mobile smartphone apps to provide tailored health education and self-monitoring assistance to patients with diabetes mellitus. A total of 13 randomised controlled trials (RCTs) were included in the meta-analysis comprising a total of 1263 patients; six RCTs detected a reduction ($p < 0.05$) of glycated hemoglobin (HbA1c) in the intervention group by trial end. Over all 13 RCTs, the mean HbA1c difference was -0.44 (CI -0.59 to -0.29; $p < 0.001$; $I^2 = 32\%$).

Comment (RD): This study joins a growing body of literature supporting mHealth tools in diabetes management. The meta-analysis showed improved glycaemic control with better outcomes seen with apps which included functionality to remotely access clinician support. Although positive findings, this study highlights the difficulty in achieving significant improvements in glycaemic control in people with diabetes as only two of the included studies were close to, or achieved the target for 'good control' (<7%). Questions remain around the generalisability of these results to the thousands of diabetes-related apps available to patients worldwide. Patients with diabetes can download an array of apps to their smartphones to support diabetes management, but many of these lack the rigour as well as the functionality to remotely access, that the apps in this review contain. Other researchers have raised questions about the safety of currently available apps, and so ensuring robust and evidence-based apps are widely available is vital.

Reference: JMIR Mhealth Uhealth 2017;5(3):e4
Abstract

Mobile phone apps for smoking cessation: Quality and usability among smokers with psychosis

Authors: Ferron JC et al.

Summary: This analysis assessed 100 randomly selected smoking cessation apps, based on US guidelines for nicotine addiction treatment (Adherence Index to US Clinical Practice Guideline for Treating Tobacco Use and Dependence) and app functions, and tested the top nine apps in 21 smokers with psychotic disorders. Most apps scored poorly on the Adherence Index, 66% rated lower than 10/100 (mean 11.5). Three common usability problems were defined: text-dense content, abstract symbols, and directions for feature editing that were too subtle.

Comment (CB): Many apps purport to be able to help people quit smoking. In this study the researchers found that only a third of the smoking cessation apps they identified on the major app stores rated above 10/100 on adherence to US smoking cessation guidelines. Of the 'good' apps, three main usability problems were reported by participants, who were all people with serious mental illness (a group among whom smoking is highly prevalent and for whom far better smoking cessation support than is currently available is urgently needed). These were: overly text-dense content, use of abstract symbols on the homepage, and directions that were too subtle. It would seem fundamental that app developers should design apps to align with best practice, that are easy to navigate and have comprehensible content, regardless of the intended end-user's mental health status, but this is clearly not the case.

Reference: JMIR Hum Factors 2017;4(1):e7
Abstract

Smartphone use in dermatology for clinical photography and consultation: Current practice and the law

Authors: Abbott LM et al.

Summary: This survey-based study assessed the current practices of 101 Australian dermatologists and dermatology trainees relating to clinical use of smartphones. More than 50% of respondents reported that they sent and/or received clinical images on their smartphones at least weekly. Usually clinical photographs were sent via multimedia message or email and stored on smartphones by 46% of respondents, with limited use of security measures. Consent for transmission of photographs and advice provided was inadequately documented and only 22% of respondents were aware of clear workplace policies regarding smartphone use. A majority desired further digital image management education.

Comment (RW): This is just the tip of the iceberg. Using smartphones to take photographs for clinical purposes just makes sense – everyone has a camera and a means of sending images in their pocket, why not use it to make providing advice quicker and more convenient for patients and fellow clinicians? Another case of commonplace technology getting ahead of our ability to use it safely and securely for clinical care. What is needed are apps that allow photos to be taken and labelled with the patient's details, that can record consent, that can integrate into electronic records so that the photo and the related clinical notes are collected and accessible, and that ensure the image can be sent or viewed securely and cannot be stored on clinicians' personal devices or mistakenly uploaded to their child's facebook page. Such apps do exist, mostly stand alone, but integrated apps (into your health IT system) are coming. Don't wait, educate yourself, ask your IT dept or start trying them out.

Reference: Australas J Dermatol. 2017;Feb 28 [Epub ahead of print]
Abstract

Independent commentary by Professor Chris Bullen, Rosie Dobson, Gayl Humphrey and Dr Robyn Whittaker

Professor Chris Bullen is a public health physician and Director of the National Institute for Health Innovation at the University of Auckland. His areas of research interest include the evaluation of novel approaches to smoking cessation, problem gambling and the prevention and management of cardiovascular disease.

Rosie Dobson is a Health Psychologist working at the National Institute for Health Innovation at the University of Auckland. Her research looks at the use of mobile technology to support behaviour change and disease management. Currently she is involved in SMS based programmes in the fields of maternal health and diabetes.

Gayl Humphrey is the Co-Lead for the Health Informatics and Technology Programme at the National Institute for Health Innovation, University of Auckland. Gayl's interest and experience in research and evaluation is on the use of technologies as enablers to support and enhance health outcomes across the health continuum.

Dr Robyn Whittaker is an Associate Professor at the National Institute for Health Innovation at the University of Auckland, where her research has been about developing and trialling mHealth (using mobile communications technologies) interventions. She is also a Public Health Physician leading the implementation of innovations, including digital health technologies, at Waitemata District Health Board.

Wearable technology in the operating room: a systematic review

Authors: Kolodzey L et al.

Summary: This review using Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) guidelines, examines the use of wearable technology in surgery, including both clinical and simulated settings. In total, 87 publications reported on use of technologies including Google Glass, GoPro or customised head-mounted displays, in a range of intraoperative clinical settings. The majority of the articles (56) discussed applications that enhance intraoperative safety and efficiency. Almost all cited issues concerning technological limitations and privacy concerns that pose barriers to widespread use of wearable technology in the operating room.

Comment (RW): Wearable sensors and other technologies are only going to become more accessible and of higher quality. Their use in medicine opens up many opportunities for improving practice, particularly for self-review, teleconsultations and for training purposes. Some newer uses in this review included ways of managing information, for anaesthesia monitoring, surgical navigation and guidance, and facilitation of surgical checklists that don't require hands or looking away at separate screens. Most of the papers in the review evaluated the use of new technologies as they became publicly available (GoPro, Google Glass, other head mounted displays/video) and these papers are important in highlighting the issues, leading to the development of better and more clinically appropriate versions of the technologies. In particular, attention is required to design for safety and increasing battery life. These early adopters may seem 'out there' to many practitioners but they pave the way for what may become standard practice in the future, keep an eye on them.

Reference: BMJ Innovations 2017;3:55-63
Abstract

Apps for people with rheumatoid arthritis to monitor their disease activity: A review of apps for best practice and quality

Authors: Grainger R et al.

Summary: This NZ study aimed to identify features and quality of smartphone apps intended to assist people with monitoring rheumatoid arthritis disease activity. In total, 19 apps (eight iTunes, three Google Play, eight from both) were identified and 14 used ≥1 validated instruments for measuring disease activity. The standard 28 swollen and tender joint count was used by seven apps, eight included ≥1 American College of Rheumatology and European League against Rheumatism (ACR and EULAR)-recommended composite disease activity (CDA) measures; and 10 included features for data storage and retrieval. One app included both a CDA measure and tracked data, but it did not include joint count. Median overall Mobile App Rating Scale (MARS) score was 3.41/5. In six apps scoring ≥4/5 for overall MARS rating, only one included an ACR and EULAR endorsed CDA score, but it did not include data tracking.

Comment (RW): Wonderful to see a NZ clinician conducting a high-quality review of available apps in her area of expertise and publishing this information to save others from having to go searching themselves! A similarly great service in NZ is currently being provided by the https://www.healthnavigator.org.nz website. Search under particular conditions and you will see clinical, technical and user reviews of health apps, with great summaries and advice on how to get the most out of the apps. This provides the confidence to recommend apps to your patients, knowing that they align with best practice in this country on the advice of local specialists/clinicians. Even better, volunteer to conduct some clinical reviews for apps in your area of interest. Don't worry, it doesn't require the extensive work that has gone into this excellent paper, but could still help out fellow clinicians and patients. Another thing these types of papers provide is high quality advice to app developers on what is important to clinicians, there is now no excuse for anyone to develop a substandard app for people with rheumatoid arthritis.

Using mobile sensing to test clinical models of depression, social anxiety, state affect, and social isolation among college students

Authors: Chow PI et al.

Summary: This study used an app to collect *in situ*, self-reported state affect (moment-to-moment experiences of positive or negative emotionality) and GPS location data from 72 US undergraduates, to examine how everyday emotional experiences are associated with a tendency to withdraw, using time spent at home as a proxy for social isolation, and whether this is influenced by symptoms of depression or social anxiety. Models of the relations between state affect and time spent at home, with levels of depression and social anxiety as moderators indicated that higher social anxiety trait scores were associated with more time spent at home or with a greater likelihood of spending time at home, and more negative or lower positive state affect scores were linked to longer homestay. Among individuals with higher social anxiety scores, higher negative affect and lower positive affect scores within a day meant a greater likelihood of spending time at home the following day.

Comment (GH): These authors are trying to identify how state affect and social isolation can help predict the risk of depression and social anxiety amongst young college students. They highlight that in earlier studies, exploring these factors often relied on self-reported measures. The advent of smart phone technology has added a new dimension for providing more objective measures of social isolation through passive sensing of location (GPS) and ecological momentary assessment enabled through surveys triggered within an app. The study does highlight some of the difficulties that need to be addressed when adopting technology as part of research and particularly when used as a research tool, e.g. such as with passive data collection. The authors highlight that they found that the different platforms (Android and iOS) behave differently and that the phone operating system version is important. These limitations resulted in only participants with Android operating systems with version 4.3 or higher being able to participate. Even with these limitations there were still software compatibility issues experienced. While the study has limitations in terms of its findings, the concept they are exploring is promising and requires more evidence-based research to support the development of a robust and reliable model.

A mobile, avatar-based app for improving body perceptions among adolescents: A pilot test

Authors: Lyles AA et al.

Summary: This pilot trial (n = 42) of an app developed for high school students assessed the acceptability and usability of an avatar-based mobile app (Monitor Your Avatar; MYA) designed to identify what they looked like based on body measurements versus what they thought they looked like or wanted to look like. Adolescents were 67% female, 83% white and 82% of the females had a healthy weight, while 50% (7/14) of the males were obese. The students had positive reactions to the avatar app and seeing avatars that represented them. All but one had a level of comfort seeing the avatars and would use the app again to track how their bodies change.

Comment (GH): Obesity is a significant public health problem worldwide. Worryingly, NZ has the third highest adult obesity rate in the Organisation for Economic Co-operation and Development (OECD) and recent estimates in NZ suggest that one in nine children are obese. Finding interventions than can help implement and reinforce changes in lifestyle, particularly in terms of eating and physical activity for young people are important. Salient influences on body image include the media, which can target young people and influence shape beliefs about the perceived body ideal. Internalisation of, and pressures to conform to, these socially prescribed body ideals often are key contributors to the development of negative body perceptions and subsequent negative lifestyle behaviours. This pilot study is a good example of exploring interventions that have resonance with today's digitally connected young people. The use of a personalised avatar that reflects the participant's reality is an innovative approach and the findings suggest acceptability amongst the pilot participants. How this will actually play out when tested in a larger cohort and over time, will be important to understand before considering this as a viable intervention option, especially considering the likely funds needed to create and maintain the app and adapt to future technology developments. Certainly worth considering.

Reference: JMIR Serious Games 2017;5(1):e4
Abstract

Analyzing mHealth engagement: Joint models for intensively collected user engagement data

Authors: Scherer EM et al.

Summary: This analysis presents longitudinal engagement data from an evaluation of a mobile health intervention for people with schizophrenia and examines the use of the joint modeling approach applied to longitudinal engagement outcome and time-to-dropout data to determine an unbiased inference on the engagement outcome. The analysis suggested a strong relationship between engagement and reduced dropout risk; using the app 1 day more per week had a 23% lower risk of dropout (p < 0.001). Engagement decline over time was steeper with the joint model versus a naive model.

Comment (GH): This study presents the important question of interpreting engagement in treatment as it applies to mobile health initiatives. The authors highlight that missing data in mobile health needs to be considered similarly to missing data in conventional treatment studies. They present a shared parametric model where processes of engagement and time-to-drop out allowed for the engagement to be analysed over time. They assert that more attention needs to be given in mobile health studies to account for the potential of non-ignorable missing data so as to accurately account for treatment efficacy. They support this assertion by presenting a naive model analysis compared to a joint model. They find that the naive model did not accurately account for the informative nature of missingness of mobile health data and as such may produce biased results that may lead to proposing a higher state of efficacy for the mobile health intervention than was actually there. As more mobile health studies are being published, it would be interesting to apply this modelling approach to test the authors' assertions.

Reference: JMIR Mhealth Uhealth 2017;5(1):e1
Abstract

The use of smartphone health apps and other mobile health (mHealth) technologies in dietetic practice: a three country study

Authors: Chen J et al.

Summary: A 52-item online survey, was used to explore use of smartphone health apps and text messaging in dietetic practice, including the types of apps recommended by dietitians and used by patients, barriers and enablers to app use, and created recommendations for supporting app uptake based on the behavioural 'COM-B' system, in which interactions of capability, opportunity and motivation modify behavior. Across the Australian, New Zealand and British dietetic associations, a 5% response rate was achieved (n = 570). Nutrition apps were used by 62% of dietitians, primarily (74%) as an information resource and for patient self-monitoring (60%). The top apps were MyFitnessPal® (62%) and the Monash University Low FODMAP Diet® (44%). Text messaging (SMS) was used by 51% of survey respondents, primarily in appointment-related purposes (84%).

Comment (CB): Many of the respondents in this online survey of dietitians in Australia, New Zealand and the UK said they used apps and SMS in their practice, but few made use of these tools as behaviour change interventions. Two thirds used apps as a source of information (about half reported using Monash University's Low FODMAP Diet®) or for patient self-monitoring (MyFitnessPal®). Text messaging was used mostly for administrative purposes, such as co-ordinating appointments. Similar findings would probably apply if the same survey was conducted in other health and allied-health professional groups. The authors concluded more training, education and advocacy was needed to enable dietitians to integrate apps and messaging into their practice as a tool for supporting patients to change behaviour. This study adds to the case for informatics to be a core element of any health professional training and continuing education.

Reference: J Hum Nutr Diet 2017;Jan 24 [Epub ahead of print]
Abstract

Balanced: a randomised trial examining the efficacy of two self-monitoring methods for an app-based multi-behaviour intervention to improve physical activity, sitting and sleep in adults

Authors: Duncan MJ et al.

Summary: This 9 week, 2-arm, randomised trial, will compare device-entered (including use of an activity tracker) or user-entered self-monitoring methods, in participants undertaking a "Balanced" multi-behavioural intervention, delivered via an app and including education materials (guidelines, strategies to promote behaviour change), goal setting, self-monitoring and feedback support, to improve physical activity, sedentary, and sleep behaviour in 64 physically inactive subjects, who report sitting >8 hours/day and frequently getting insufficient sleep (≥14/30 days).

Comment (CB): This article outlines the protocol for an Australian trial of an app ("Balanced"), comprising a package of guidelines and strategies for behaviour change, goal setting, self-monitoring and feedback support to improve physical activity, sedentary behaviour and sleep behaviour in physically inactive adults who report insufficient sleep. Intriguingly, the primary comparison in the trial is the relative efficacy of two approaches to self-monitoring: device-entered (activity tracker) or user-entered (recall and manually record behaviours). Objective measurement will be enabled by the wrist-worn GENEActiv accelerometer. There is no 'usual care' or placebo arm, so it will not be possible to assess if the app improves activity, reduces sedentary behaviour and improves sleep - and with assessments over only 9 weeks and a small sample size (n = 64) this is at best a pilot trial.

Reference: BMC Public Health 2016;16:670
Abstract