Digital Health Research Review™

Making Education Easy

Issue 2 – 2017

In this issue:

Abbreviations used in this issue
ASD = autism spectrum disorder
ESM = experience sampling method
OA = osteoarthritis
RCT = randomised controlled trial

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Welcome to the second 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 apps and other platforms designed to improve health outcomes.

We hope you find our 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 Rosie Dobson and Gayl Humphrey for their contribution to this issue of Digital Health Research Review.

Kind regards,

Dr Robyn Whittaker
robyn.whittaker@researchreview.co.nz

Mental health mobile apps for preadolescents and adolescents: A systematic review

Authors: Grist R et al.

Summary: This review systematically appraised evidence published between January 2008 and July 2016 on the efficacy and acceptability of mental health mobile apps (targeting depression, bipolar disorder, anxiety disorders, self-harm, suicide prevention, conduct disorder, eating disorders, body image issues, schizophrenia, psychosis, or insomnia) for children and adolescents <18 years. In total, 24 publications were assessed covering 15 apps (two available to download). A significant effect of apps on intended mental health outcomes were not demonstrated in two small randomised trials and one case study, a further six apps available to download for children and adolescents had not undergone any research evaluation. App acceptability was good and usage was moderate.

Comment (RD): Ensuring access to evidence-based intervention for adolescents with mental health problems is essential for reducing harm and long-term illness. There is potential for technology to reduce the barriers for young people associated with accessing face-to-face support including stigma. There is increasing interest in, and support for, technological solutions for young people with mental health problems including internet interventions, mobile apps, text messaging, and serious games. For example, here in New Zealand, SPARX, an evidence-based freely available online computer programme for young people with mild-to-moderate depression, stress or anxiety, has been shown to be effective in reducing depression, anxiety and feelings of hopelessness. Unfortunately, as is highlighted in this paper, very few studies have evaluated the effectiveness of mobile apps for adolescents or preadolescents with mental health problems. The authors therefore conclude that there is insufficient evidence for the effectiveness of apps for this population. Unfortunately, good research takes time and with the plethora of apps being developed, the lag between release and research is only growing. Until robust research is available on the safety and efficacy of apps for mental health problems, caution must be shown before using or recommending these.

Reference: J Med Internet Res 2017;19(5):e176

Abstract

Kids'Cam: An objective methodology to study the world in which children live

Authors: Signal LN et al.

Summary: The Kids'Cam Food Marketing study illustrates a new methodology to objectively study the world in which children (aged 11-13 years; n = 168) live using wearable cameras and GPS units for 4 days, recording imagery every 7 seconds. Analysis is ongoing and involves manual coding of 1.4 million images for variables of interest including setting, marketing media, and product category. Potential variables to be analysed include exposure to advertising for alcohol, smoking, "blue" space and gambling, and their use of "green" space, transport, and sun protection.

Comment (RW): This paper demonstrates the potential for technology to vastly improve data collection for many different purposes. The need for burdensome active manual data collection by participants or researchers will disappear, as passive technological methods improve and get cheaper. Methods such as the photographic images captured here, will also increase the accuracy and reduce biases inherent in human-dependent methods of data collection or recollection. In this particular case, the wearing of cameras by kids provided valuable information on their exposure to advertising. It is perhaps a small step from here to 'wearable' methods of image and data capture, coupled with machine learning capable of analysing enormous amounts of data, providing us with near real-time feedback on our environment as we move around within it.

Reference: Am J Prev Med. 2017; S0749-3797(17)30163-0

Abstract

A randomised controlled trial of an iPad-based application to complement early behavioural intervention in autism spectrum disorder

Authors: Whitehouse AJ et al.

Summary: This randomised controlled 6-month trial evaluated a technology-based early intervention programme (Therapy Outcomes By You; TOBY) in young children (mean age 3.4 years) with autism spectrum disorder (ASD) who received either a standard community-based intervention (n = 39) or TOBY therapy for >20 min/day plus community-based intervention (n = 41). TOBY recipients averaged 19 min/day engagement during the first 3 months of the trial, but only 2 min/day over the second 3 months. There was no difference between groups in the primary outcome, the Autism Treatment Evaluation Checklist, at 3 or 6 months. However, TOBY recipients demonstrated 6-month improvements in three secondary outcomes (Fine Motor and Visual Reception subscales of the Mullen Scale of Early Learning; Total Words Understood scale of the MacArthur-Bates Communicative Development Index).

Comment (RD): This Australian study utilises an app which assists in structuring and delivering home-based therapy for children with ASD. Although a significant result was not seen in the primary outcome, autistic symptom severity, positive trends were seen in other key outcomes, indicating the potential for this type of low-cost intervention. Decreasing engagement with apps over time is an ongoing issue not limited to this app, and is an area where further work is needed. Access to early and intensive behavioural interventions for children with ASD can be limited with interventions in the traditional therapy environments being resource intensive. There is considerable potential for well-designed digital tools such as apps to increase access to therapeutic intervention as well as to provide support for caregivers to structure interventions within the home. This could have significant positive impacts on outcomes for children and their families as well as healthcare resources.

Reference: J Child Psychol Psychiatry 2017;May 25 [Epub ahead of print]
Abstract

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

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.

Telehealth interventions to support self-management of long-term conditions: A systematic metareview of diabetes, heart failure, asthma, chronic obstructive pulmonary disease, and cancer

Authors: Hanlon P et al.

Summary: This metareview (systematic review of systematic reviews) aimed to synthesise evidence for telehealth-supported self-management and its effects on disease control and health care utilisation in conditions including diabetes (types 1 and 2), heart failure, asthma, chronic obstructive pulmonary disease (COPD) and cancer. A total of 53 systematic reviews evaluated 232 unique RCTs on diabetes (type 1 n = 6; type 2 n = 11; mixed n = 19), heart failure (n = 9), asthma (n = 8), COPD (n = 8), and cancer (n = 3). The highest quality-weighted reviews (A Measurement Tool to Assess Systematic Reviews) indicated that glycaemic control in type 2, but not type 1 diabetes, was improved by telemonitoring with feedback on blood glucose levels and some educational and lifestyle interventions. Some reviews also showed that telemonitoring and telephone interventions reduced heart failure mortality and hospital admissions. Results for other conditions were mixed, but there was no evidence of harm. Multifaceted and more intensive interventions were associated with greater improvements in diabetes, heart failure and asthma.

Comment (RD): Although this extensive metareview did not find telehealth self-management interventions to be superior over standard care in long-term conditions, it does provide support that they are a safe option particularly in diabetes and heart failure. Across the 53 systematic reviews included in the paper none reported negative effects supporting the use of technology as an alternative for the delivery of self-management support. This has potential for increasing the reach of self-management support as traditional services are not always available to everyone. Inadequate descriptions of self-management intervention components, and analysis of their relationship to outcomes, meant the authors were unable to draw conclusions about which components were most beneficial, and in what long-term conditions. Understanding the components of effective interventions is essential for future development and better reporting of the intervention design, components and theoretical underpinnings is needed. Not surprisingly the authors conclude that large scale quality trials with robust reporting are needed to better ascertain the effectiveness of telehealth interventions.

Reference: J Med Internet Res. 2017;19(5):e172
Abstract

The experience sampling method as an mHealth tool to support self-monitoring, self-insight, and personalized health care in clinical practice

Authors: van Os J et al.

Summary: This study reports on the experience sampling method (ESM) to build an intensive time series of experiences and contexts in daily life (typically 70 reports, collected at 8-10 random time points per day for up to 10 days), and includes discussion of an ESM evaluation of a 6-week randomised mindfulness trial and a twin study on emotion dynamics. The use of ESM-based self-monitoring and feedback enhanced resilience by using natural rewards. Personalised medication use can be more easily initiated and predicted if sensitive real time feedback data are available. In addition, the use of personalised data supports shared decision-making.

Comment (GH): This is a highly comprehensive and detailed paper describing different uses of ESM. ESM is an intensive way to collect time series information on experience and context of participants and allows researchers access to areas and aspects of participants' experiences that can help them better understand what influences and shapes these experiences. As a research tool, it affords a reduction in retrospective bias inherent in self-report data. By exploring the multiple instances of the participant experience over time, it becomes possible to disentangle which effects are due to individual differences and which are contextual factors. This is seen as an important feature in working with people being treated for depression or other mental health illnesses. While the potential is tremendous the missing piece of information is the practical aspect. The design phase is highly complex, the technical and participant burden is still high and while the authors remark that ESM could enhance clinical practice, the cost alone may be prohibitive. However, with the growth in machine learning techniques, the ubiquitousness of mobile phones and wearable devices, ESM is worth keeping an eye on as it has the potential to be highly valuable in both research and health care.

Reference: Depress Anxiety 2017:34(6):481-93
Abstract

Assessing the impact of a novel smartphone application compared with standard follow-up on mobility of patients with knee osteoarthritis following treatment with Hylan G-F 20: A randomized controlled trial

Authors: Skrepnik N et al.

Summary: This randomised, multicentre, controlled, open-label study tested a mobile app (OA GO) plus a wearable activity monitor/pedometer (Jawbone UP 24) providing visible feedback (unblinded; n = 107) versus Jawbone only with no visible feedback (blinded; n = 104) for 90 days in patients with knee osteoarthritis treated with hylan G-F 20. The increase in least squares (LS) mean number of steps per day was greater in OA GO (1199) than in Jawbone only (467; p = 0.03) recipients as was the mean percentage change (35.8% vs 11.5%; p = 0.02). Pain reduction from baseline during the 6-minute walk test was also better in OA GO recipients (LS mean change -55.3 vs -33.8; p = 0.007). A majority of patients (65.4%) and physicians (67.3%) indicated they were likely or very likely to use/recommend the devices.

Comment (GH): This is a pharma (Sanofi) funded RCT undertaken in the US on people with osteoarthritis. There are a number of limitations to the design and eligibility criteria; however, notwithstanding that, the paper does highlight nicely that what happens between health care visits is an important part of the health and wellbeing of patients. The traditional paternalistic approach of providing advice to move more, eat less, and behave differently, often repeated at each visit, is being replaced with technological tools that can provide the support that is needed to enable that advice. This paper is just a nice example that illustrates this relatively simply. The authors highlight that for people with osteoarthritis, regular walking has a positive effect on maintaining mobility and on reducing pain, yet, regular walking is low for this group. By adding in a wearable device (Jawbone) and an activity/feedback app (OA GO) the intervention group reported an improvement across the various domains of pain, patient activation and an overall acceptability of the use of technology plus a statistically significant difference in activity (measured by steps) amongst the intervention cohort comapred with the control group (p= 0.03). So while the study design itself is less than perfect, the role of good technological tools that enable data collection, feedback loops, and self-monitoring capability is certainly worth the growing research focus.

Reference JMIR Mhealth Uhealth 2017;5(5):e64
Abstract

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Using a medical Intranet of Things system to prevent bed falls in an acute care hospital: A pilot study

Authors: Balaguera HU et al.

Summary: This US study conducted a technology evaluation (feasibility, usability, user experience) of an Intranet of Things (IoT) system, using a sensor pad placed between the top of their mattress and bed sheet, to facilitate nursing response to bed exits in 91 medical-surgical patients. The system was opperational for 234.0 patient-days and no bed falls occurred during the study period. Patients were assisted/returned to bed a mean of 46 seconds after the alert system was triggered. Longer response times occurred during the overnight shift versus the day shift ($p = 0.005$), but independent of patient location. Nurses found the system integrated well into the workflow and the alerts were helpful.

Comment (RW): This is a vendor sponsored trial which should be noted. However, it is rare to see a decent peer-reviewed paper in a medical journal of such a trial, most often seen in computer science conference proceedings or vendor glossy promotional materials. This is still an early study, mostly about feasibililty and acceptability to staff, but with some indication of accuracy with a positive predictive value of 62% (i.e. the probability that an alert signalled an event that actually required intervention). These types of systems are of interest, falls in hospital are a major issue, often causing significant harm to the individual and prolonging length of stay in hospital. This system allows staff to respond early, from wherever they are, due to the mobile phone alerting to a high risk patient trying to get out of bed. If this prevents falls it will be worthwhile, although larger trials of effectiveness and cost-effectiveness will be required

Reference: J Med Internet Res. 2017;19(5):e150
Abstract

Activity recognition for persons with stroke using mobile phone technology: toward improved performance in a home setting

Authors: O'Brien MK et al.

Summary: This study aimed to validate the performance of activity recognition systems for smartphones in 30 gait-impaired stroke patients using training activities versus 15 normal people in laboratory and home settings. A custom-built app collected signals from the phone's accelerometer, gyroscope and barometer sensors, and a random forest activity recognition model was trained using either healthy- or post-stroke-activity data. The model trained on post-stroke activity data was better than one trained on healthy-activity data, average recall improved from 53% to 75%. Performance of the healthy-trained model declined as gait impairment severity increased, misclassifying ambulatory activities as stationary. Likewise the model using in-lab data performed worse on at-home activities (56%) than different day in-lab activities (77%).

Comment (GH): There is a substantial growth in the discourse on the value of activity monitors for a wide variety of populations. Embedded within smartphones or as separate wearables the activity monitors include an increasingly sophisticated array of measuring tools, including geopositioning systems, gyroscopes, accelerometers and barometers. The authors of this paper do a great job reminding the reader that when these tools are to be used to support someone or be the basis for an intervention, then a substantial amount of work must be done to ensure that the outputs from these tools are accurate and fit for purpose. What I found really useful and interesting was the effort to create a simple training model that can be used to accurately capture what is happening i.e. walking as opposed to going up stairs for example. The importance of creating and training your model with data from the intended cohort is clearly important. In this paper, healthy participant activity data is not a good fit to training the model that will be used to support stroke patients. Additionally, even with solving who is contributing the data to train the model, data from real world versus lab training is fraught with issues, the simplest being connectivity. In this paper, transmission drop out in the home environment was high which reduced the data available for training. Finally, it is not clear why the study uses a smartphone for data collection as the participants needed to wear this continuously and remove to enter the activity going to be undertaken. The use of more tailored wearables that synchronise to a smartphone may be an option, albeit this introduces another layer of complexity, and cost. Which is a nice way of saying, we need more research and in particular good economic studies.

Reference: J Med Internet Res 2017;19(5):e184
Abstract

Development of a culturally tailored text message maternal health program: TextMATCH

Authors: Dobson R et al.

Summary: This report from New Zealand researchers describes the development of the Text for MATernal and Child Health (TextMATCH) culturally tailored text message-based maternal health programme developed for Māori, Pacific, Asian and South Asian families. Over 18 months, 1404 people registered with TextMATCH; 18.5% (n = 260) actively opted out after 0 to 17 months of messages. A total of 356 (70.9%) of 502 eligible participants switched from the pregnancy programme to the baby programme after delivery. Phone interviews with 29 participants including six withdrawals indicated that most rated the usefulness of messages positively (average 4.24 out of 5); two participants reported that the programme was not useful. All participants indicated the messages were relevant, culturally appropriate, and easy to understand and most were happy with the advice and the language options.

Comment (RW): Conflict of interest declaration: this is one of our (National Institute for Health Innovation) papers. TextMATCH is a text message health information programme that has been developed for Māori, Pacific, Asian and South Asian families in the Auckland/Waitemata districts. Pregnant women and their families can sign up to receive a programme of messages about healthy eating and physical activities that are relevant to their stage of pregnancy and their baby's development up to the age of 2 years old. The broader programme (Healthy Babies, Healthy Futures) is currently being independently evaluated, but this paper describes our own qualitative study of feedback from participants, particularly to try to answer the question about whether the resource intensive process of cultural adaptation and translation of messages is appreciated. It seems to us like it is the usual story, if it is done well, people don't even notice. However, if any messages are not appropriate, people are quickly turned off a programme. Through this study we were able to identify some messages that were not considered entirely appropriate and remove or change them. This is an important part of continual improvement of our programme.

Reference: JMIR Mhealth Uhealth 2017;5(4):e49
Abstract

A systematic review of smartphone applications for smoking cessation

Authors: Haskins BL et al.

Summary: This review used Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to assess the proportion of scientifically supported, commercially available, smartphone health apps. Seven articles were identified that provided six apps with some level of scientific support, three (50%) of which were available in at least one app store. Among the top 50 apps in each of the leading app stores, only two (4%) had any scientific support.

Comment (RW): As the author of the Cochrane systematic review of the use of mobile phones for smoking cessation, I have been saying for many years that text messaging has been well proven to be effective in supporting people to quit smoking, but the evidence for any smartphone apps has been lacking. At last the trials are starting to come in. As we already knew, few follow good evidence-based practice in cessation support, and as we guessed, few have shown any evidence of effectiveness. Those that have been the subject of study are not available or not easily found within the current app stores. As providers, we should be promoting those that do have evidence of benefit. Healthnavigator.org.nz is one place that is trying to do this; apps are reviewed by NZ clinicians, technicians and users. Their reviews are nicely displayed, often accompanied by videos/tips on how to get the most out of the app. Get familiar with consumer apps in your area of specialty by reading the reviews on the website, if there aren't any, recommend some, and better still offer to help out with the reviews.

Reference: Behav Med Pract Policy Res. 2017;May [Epub ahead of print]
Abstract