

# Digital Health Research Review™

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Issue 3 – 2017

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### Abbreviations used in this issue

**HEI** = healthy eating index  
**mHealth** = mobile health  
**RCT** = randomised controlled trial  
**SMS** = Short Message Service  
**TSB** = total serum bilirubin



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**Welcome** to the third 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 Karen Day, 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](mailto:robyn.whittaker@researchreview.co.nz)

## Use of a smartphone app to assess neonatal jaundice

**Authors:** Taylor JA et al.

**Summary:** This US study in 530 neonates (20.8% African-American, 26.3% Hispanic, 21.2% Asian-American) tested the accuracy of a smartphone digital imaging application called BiliCam for the estimation of bilirubin levels in outpatient neonates and compared them with total serum bilirubin (TSB) levels. The overall correlation between BiliCam estimated bilirubin and TSB levels was 0.91, with similar correlations among white (0.92), African-American (0.90), Hispanic (0.91), and Asian-American (0.88) subgroups. BiliCam sensitivities for identifying neonates with high TSB levels (high-risk zone  $\geq 75^{\text{th}}$  percentile] on the Bhutani nomogram) was 84.6% with a specificity of 75.1%. The sensitivity of identifying a neonate with a TSB level of  $\geq 17.0$  mg/dL was 100% with a specificity of 76.4%.

**Comment (RW):** So I have to admit that I love any smart but simple, novel use of the smartphone, particularly when it is undertaken within a research framework. Not being a specialist in this area I can't attest to the need for this particular development, but the fact that it has been published in *Pediatrics* (not a technology journal) gives me some assurance that paediatricians are interested. Also, as a public health physician, any cheap non-invasive test that can improve access to screening and help target the need for more invasive tests, seems like a good thing. Taking images using smartphone cameras is a double-edged sword in the health service, the fact that everyone has a high-quality camera in their pockets means that clinicians everywhere are using them for clinical uses; however, we need to ensure the photos are taken in a way that they can be used and value can be easily added through analytics. These folks have come up with an easily distributed and used colour calibration card that is placed on the baby's chest, thereby allowing the 'machine' to do its magic on analysing the colour with respect to identifying hyperbilirubinaemia. I would expect that the sensitivity, specificity and positive predictive value of this system will continue to improve.

**Reference:** *Pediatrics* 2017;140(3):pii: e20170312

[Abstract](#)

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

**Karen Day**, PhD, FACHI, is Programme Director for postgraduate studies in health informatics. Her research spans telehealth, patient portals, evaluation of digital health implementations, and focuses on the patient's experience of using information technologies for self-care of long-term health issues.

**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.

## Is there evidence of cost benefits of electronic medical records, standards, or interoperability in hospital information systems? Overview of systematic reviews

**Authors:** Reis ZSN et al.

**Summary:** This meta-review of systematic reviews analysed the cost-effectiveness and quality of care impact of electronic in-patient data systems, health information exchanges, or standards that support interoperability among systems. In total, six systematic reviews were identified, but no measurable effect of implementation of eHealth interventions on cost-effectiveness was observed. Quality of care benefits were identified for hospital information systems and information sharing, by reducing staff errors or incidents, improving automated harm detection, more effective infection monitoring, and enhanced continuity of care during physician handoffs.

**Comment (RW):** I find it really interesting that in the context of the size of health services' spend on electronic medical records of various descriptions around the world, there is so little research published on their cost-effectiveness. This review of reviews found that there are specific examples of improvements in some measures of quality, efficiency and patient outcomes, but no overall measure of the impact of a comprehensive electronic medical system and sharing of health data on patient outcomes, and next to no studies publishing cost-effectiveness. This is a call for more high quality evaluations of the impact of implementing new systems to be published so that we can all learn from them in setting priorities for digitalising our hospitals.

**Reference:** *JMIR Med Inform.* 2017;5(3):e26

[Abstract](#)

## Use of and beliefs about mobile phone apps for diabetes self-management: Surveys of people in a hospital diabetes clinic and diabetes health professionals in New Zealand

**Authors:** Boyle L et al.

**Summary:** This single centre survey was conducted to determine characteristics of the use of mobile phone apps for diabetes mellitus self-management in Wellington among diabetic patients (n = 539) and health professionals (n = 286). The patient survey elicited 189 (35.0%) responses of which 37 (19.6%) had used a diabetes app. In general the app users were younger and more users had type 1 diabetes. The most favoured app feature (87%, 32/37) was a glucose diary, and an insulin calculator was the most desired function for future development (46%, 17/37). Among those who did not use an app, the most desired feature was a glucose diary (64.4%, 98/152). The health professional survey received 115 (40.2%) responses, with 60.1% (68/113) indicating they had previously recommended a diabetes app. Blood glucose diaries and carbohydrate counting were the most useful features and the ones they felt most confident in recommending. Health professionals were least confident recommending insulin calculation apps.

**Comment (RW):** Of course we love to read New Zealand studies. These authors found that just under 20% of people with diabetes visiting their clinics were using diabetes apps, although more said they were interested in using them for glucose diaries or insulin calculators. Interestingly, around 60% of clinicians interviewed (predominantly dietitians) said they had recommended an app to their patients. I'm going to use this opportunity to again put in a plug for [healthnavigator.org.nz](http://healthnavigator.org.nz)'s online app library. I would like to see this as the one place New Zealand clinicians go in order to recommend apps to their patients. If the apps you want to recommend to your patients aren't there, get in touch and ask them to review it, indeed provide the clinician review yourself (mainly whether the app aligns with New Zealand best practice). But of course I'm going to remind you that mHealth is not just about apps, watch out for coming results of our text message self-management support programme for people with poorly controlled diabetes! We might even review it here (or get someone else to).

**Reference:** *JMIR Mhealth Uhealth* 2017;5(6):e85

[Abstract](#)

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### Who uses mobile phone health apps and does use matter? A secondary data analytics approach

**Authors:** Carroll JK et al.

**Summary:** Data from the US National Cancer Institute's 2015 Health Information National Trends Survey (HINTS; n = 3677) were analysed to identify socio-demographic characteristics associated with health app use, attitudinal and behavioural predictors of health apps use for health promotion, and the association between health-related app use and achievement of recommended fruit and vegetable intake and physical activity. A reduced likelihood of having adopted health apps was associated with older age (45-64 years; OR 0.56; 95% CI 0.47-68; 65+ years; OR 0.19; 95% CI 0.14-0.24), male sex (OR 0.80; 95% CI 0.66-0.94), or less than high school education (OR 0.43; 95% CI 0.24-0.72), while degree completion was associated with increased health app adoption (OR 2.83; 95% CI 2.18-3.70). Age and education were also predictive for adoption of a mobile device, especially college graduation (OR 3.30). App adopters were more likely to report an intention to improve fruit (63.8% vs 58.5%;  $p = 0.01$ ) and vegetable (74.9% vs 64.3%;  $p < 0.01$ ) consumption, increase physical activity (83.0% vs 65.4%;  $p < 0.01$ ) and aim to lose weight (83.4% vs 71.8%;  $p < 0.01$ ). App adopters were more likely to meet physical activity recommendations than those without a device or health apps (56.2% vs 47.8%;  $p < 0.01$ ).

**Comment (RD):** Health apps are a readily available tool to support people to make healthy behaviour change in their everyday lives but not surprisingly this study found that the main users of health apps are younger, more educated and are healthier. The authors note that users of health apps may have greater motivation and interest in changing their diet, weight, or physical activity, and therefore this technology may be better suited to those ready to change their behaviour or already actively involved in their health to support them to engage in the behaviour and maintain changes. This study, using data from a US cross-sectional survey, supports evidence of a digital divide with findings consistent with international research showing that younger people with higher education and income are more likely to have access to smartphones compared to older, less educated, and lower income individuals. Although the authors conclude that socio-demographic factors are becoming less potent in this area, both researchers and clinicians must consider the digital divide when developing and/or recommending health apps to patients, as there is potential for this type of health intervention to contribute to health disparities.

**Reference:** *J Med Internet Res.* 2017;19(4):e125

[Abstract](#)

### The use of mobile apps and SMS messaging as physical and mental health interventions: Systematic review

**Authors:** Rathbone AL et al.

**Summary:** This review examined the use of mobile apps and SMS messages as mobile health (mHealth) interventions for self-guided care. A literature review from 2008-17 identified 27 studies (19 RCTs; 8 within-group studies) with a total of 4658 participants. The studies identified improvements in physical health and reductions in measures of anxiety, stress and depression. Effect sizes (Cohen's d within- and between-group) ranged from 0.05-3.37 (immediately post-test), 0.05-3.25 (1-month follow-up), 0.08-3.08 (2-month follow-up), 0.00-3.10 (3-month follow-up), and 0.02-0.27 (6-month follow-up).

**Comment (KD):** Interventions designed on the mHealth platform have mixed results in terms of their effect, with many such interventions not demonstrating an effect over and above that of the control. This literature review showed that in the last decade there has been an increase in the purposive design of apps and SMS interventions, and an increase in their effect, albeit a mixed increase. The literature review is not homogenous, but does reflect some useful results. It is interesting to note that while the effects of the interventions were wide-ranging, the utility and perceived usefulness of the interventions were high. mHealth apps and SMS interventions show promising results and there should be more testing to build the evidence base.

**Reference:** *J Med Internet Res.* 2017;19(8):e295

[Abstract](#)



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## Barriers and facilitators for the use of a medical mobile app to prevent work-related risks in pregnancy: A qualitative analysis

**Authors:** Velu AV et al.

**Summary:** This paper reports on a thematic overview of perceived facilitators and barriers to use of a mobile app to prevent occupational-related pregnancy complications based on multidisciplinary focus groups including pregnant women, medical professionals, trade unions and employers. Potential facilitators (25) and barriers (12) to use of an app were identified in four categories: content, the app as a means to provide information, ease of use, and external factors. The three main facilitators were a good user interface, apps as a more practical source of information, and understandable information. The two main barriers were extensive battery and memory use and frequent push notification.

**Comment (KD):** About 57% of employed women are of childbearing age. Only 25% of these women are aware of the effect of working conditions (e.g., chemical exposure, stress, long working hours) on their pregnancy and baby (e.g., preterm, foetal abnormalities, low birth weight). In the Netherlands, 25% of pregnant women are exposed to these working conditions. Thoughtful design of apps is essential for the uptake of innovative solving of problems, especially when not perceived to be problems by those affected. Establishing the facilitators and barriers to the use of an app before designing it is sound software practice, and this study is an exemplar. It would be interesting to see how the final app turns out.

**Reference:** *JMIR Res Protoc.* 2017;6(8):e163  
[Abstract](#)



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## Evaluation of a smartphone nutrition and physical activity application to provide lifestyle advice to pregnant women: The SNAPP randomised trial

**Authors:** Dodd JM et al.

**Summary:** This analysis of two South Australian multicentre, nested randomised trials estimated the impact of a smartphone application in facilitating dietary and physical activity change among 162 pregnant women; 77 received lifestyle advice plus a smartphone app and 85 lifestyle advice only. The mean difference in healthy eating index (HEI) score between the groups was 0.01 (95% CI -2.29 to 2.62) after 28 weeks of pregnancy and -1.16 (95% CI -4.60 to 2.28) after 36 weeks. There was no additional benefit in improving the HEI score with the application ( $p = 0.452$ ).

**Comment (KD):** There is concern globally about obesity, particularly about the effect of obesity and weight gain during pregnancy. There are well-established guidelines about pregnancy-related nutrition and these were clearly observed in the study. However, pregnant women value their relationships with their maternity care team members and this, although not explored in the study, may have influenced their decision to use or not use the app. The app, as a reinforcement tool for healthy lifestyle while pregnant, may have benefited from more deliberate design to engage users in games and enable access to the relationships considered meaningful by pregnant women.

**Reference:** *Matern Child Nutr.* 2017;Aug 24 [Epub ahead of print]  
[Abstract](#)

## The use of Facebook in recruiting participants for health research purposes: A systematic review

**Authors:** Whitaker C et al.

**Summary:** The current use and success of Facebook to recruit participants for health research purposes was evaluated in this study which reviewed the literature from MEDLINE, EMBASE, Web of Science, PubMed, PsycInfo, Google Scholar, and a hand search of article references, in the 12 years up to March 2017. A total of 35 studies from the United States ( $n = 22$ ), Australia ( $n = 9$ ), Canada ( $n = 2$ ), Japan ( $n = 1$ ) and Germany ( $n = 1$ ) were identified that focused on the feasibility of recruitment via Facebook, with some ( $n = 10$ ) also testing interventions, such as smoking cessation and depression reduction. The majority of the studies recruited young age groups (16-24 years), but the rest targeted specific demographics, for example, military veterans. Analysis revealed a median of 264 participants recruited for each study during a median 3-month recruitment period. There were 3.3 million impressions, a cost per click of US\$0.51, a conversion rate of 4% (range 0.06-29.50), an eligibility of 61% (range 17-100), and a cost per participant of US\$14.41. Except for an over representation of young white women, the studies found the results representative of their control or comparison demographics, and revealed success in penetrating hard to reach populations. The authors concluded that there is growing evidence to suggest that Facebook is a useful recruitment tool and its use, therefore, should be considered when implementing future health research.

**Comment (GH):** Recruitment of participants into research can be difficult and I surmise that all researchers at some time in their careers have been stressed about achieving recruitment numbers or worried about the representation of hard to reach groups in their participant population. Increasingly, social media has been promoted as the "nirvana" vehicle for recruitment potential. The ability for social platforms such as Facebook to target recruitment adverts to specific groups or regions or age groups is potentially game changing for research. Does it live up to the potential? It is early days as these authors remark. They note that while Facebook certainly seems to confirm that recruitment is less costly, the reach is high, the conversion rates are good and achieving numbers is quicker. Where caution is needed depends on who you want for your study as almost all the studies participants were under the age of 30 years, and there was a tendency to have more females. However, studies that were recruiting known hard to reach or marginalised groups such as drug users, or had research topics such as sexual behaviour, yielded better recruitment than traditional methods. What did not seem to improve via Facebook recruitment was ethnic diversity, which may just signal the inadequacies of the recruitment material. However, I tend to agree with the authors conclusions, in that the evidence is growing that Facebook is a successful research participant recruitment tool (for some groups).

**Reference:** *J Med Internet Res.* 2017;19(8):e290  
[Abstract](#)

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## Using computer, mobile and wearable technology enhanced interventions to reduce sedentary behaviour: a systematic review and meta-analysis

**Authors:** Stephenson A et al.

**Summary:** This study evaluated the effectiveness of technology-enhanced interventions such as mobile applications, activity monitors, prompting software, texts, emails and websites aimed at reducing sedentary behavior in healthy adults and examined the behaviour change techniques used. A total of 17 eligible RCTs published up to June 2016 including interventions using computer, mobile or wearable technologies to facilitate a reduction in sedentary behavior and using a measure of sedentary time as an outcome, were identified from five electronic databases. A meta-analysis of 15 RCTs revealed a mean reduction of -41.28 min/day of sitting time (95% CI -60.99 to -21.58,  $I^2 = 77%$ ,  $n = 1402$ ), in favour of the intervention group (computer, mobile and wearable technology tools) at endpoint follow-up. Mean reductions at short ( $\leq 3$  months), medium ( $>3$  to 6 months), and long-term follow-up ( $>6$  months) of -42.42 min/day, -37.23 min/day and -1.65 min/day, respectively, were identified upon pooled analysis. Only one of the 17 included studies was considered to be at low risk of bias while the others had a high or unclear risk. Overall, 46 behaviour change techniques were implemented, including 14 unique techniques; the most frequently used were “prompts and cues”, “self-monitoring of behaviour”, “social support (unspecified)” and “goal setting (behaviour)”.

**Comment (GH):** Obesity is the focus of almost every developed and some emerging, countries of the world. The causes of obesity are multifaceted and it is clear that the solutions will also be multifaceted. A common theme across much of the emerging literature is the role of mHealth as a solution platform for delivering solutions. This paper found that the evidence is growing in support for these technology-based interventions but there are still cautionary elements with regard to the design, study length and measuring outcomes. Despite this, what this paper also shows is how rapidly research is growing (in this case reducing sedentary behaviour by using technology) to sufficiently enable a systematic review and meta-analyses to be undertaken. Why is this important? By being able to summarise the existing research on a topic, means that there is an ability to increase statistical power for the primary endpoints and even enable insights to emerge for subgroups, which is often lacking in single studies. These meta-analyses also can help with [possibly] improving estimates of the size of the effect and help resolve uncertainty. It is through these reviews that better judgments can be made about that evidence and that is useful for informing recommendations for healthcare.

**Reference:** *Int J Behav Nutr Phys Act.* 2017;14(1):105

[Abstract](#)



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## Effectiveness of mobile health (mHealth) interventions for promoting healthy eating in adults: A systematic review

**Authors:** McCarroll R et al.

**Summary:** This study investigated whether mHealth interventions, delivered via mobile devices, could provide a sustainable solution to promote healthy eating in adults. Five scientific databases were searched for eligible studies examining healthy eating interventions delivered via a mobile device and published up to 1 July 2016. A total of 879 articles were identified and 23 deemed suitable for inclusion in the analysis. While the evidence base was deemed insufficient (studies are of poor quality) to determine conclusive positive effects, the narrative review results indicated small positive effects of mHealth interventions on healthy eating (5/8 trials) and weight loss (5/13 trials).

**Comment (GH):** The authors do a great job in gathering and presenting the evidence for the use of mHealth interventions in promoting healthy eating. They found 23 eligible RCTs from 2008 to 2016 but report (sadly) that overall the studies were of low to poor quality with inadequate reporting of results and methods and high attrition rates. While a meta-analysis was not possible, what should be of interest is that the technology used in the studies that were of a better quality (including adequate power and longer follow-up) used text messaging as a core intervention element. The interventions included participants supplying self-monitored information and the programme providing tailored feedback by text message. The positive effect on health behaviour of text messages and tailored feedback, has been shown in other topic areas such as smoking cessation. So a question I ask myself is, “despite the exponential growth of Star Trek like functions now possible from our smart phones, is the simple text message still the key evidenced-based tool for supporting behaviour change?”

**Reference:** *Prev Med.* 2017;Sep 4 [Epub ahead of print]

[Abstract](#)

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