3RD CBC DIGITAL HEALTH CONFERENCE

HARNESSING DIGITAL TECHNOLOGY FOR BEHAVIOUR CHANGE

Abstract Booklet

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INSTITUTE OF DIGITAL HEALTH

Contents

Oral Presentations

Day 1: 22nd of February

1. ### A digital decision aid for curatively treated breast cancer patients to effectively influence aftercare trajectory choices, hospital costs and shared decision making

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Rationale: Due to improved survival rates, an increasing number of breast cancer patients now survive and require some form of aftercare. Research showed that individualizing aftercare is more cost-effective than delivering aftercare at regular standard intervals. Therefore, the first digital aftercare decision aid was developed and tested with the current pilot test. It was expected that offering patients a digital decision aid, would result in more patients choosing less intensive forms of aftercare to better suit their preferences.

Aims: The aim of this study was to evaluate the effect of the digital decision aid on aftercare trajectory choices, hospital costs, perceived shared decision making and patient-reported choice evaluation.

Methodology: A prospective before-and-after pilot study, including 50 patients in the control group (usual care) and 50 patients in the experimental group (use of digital decision aid during consultation with an oncology nurse) was conducted in 6 hospitals. The patients filled out a short survey at three different measurement points; one week before the decision regarding aftercare (made in a scheduled consultation with a health professional), directly after the decision regarding aftercare and three months after the decision.

Analysis: MANOVA, Mann- Whitney U test, ANOVA and Chi-square tests were performed to analyse the data. Effect sizes were also calculated for SDM-Q-9 scores and hospital costs.

Results: Patients that used the decision aid were more likely to choose a less intensive aftercare trajectory than patients in the control group (χ^2=3.84; df=1; P<.05), resulting in lower hospital costs (with medium to large effect (η^2= .096)) although not statistically significantly in the experimental group (M= 48.15; SD=21.15) compared to the control group (M=136.03; SD=21.15) (F=3.09; P=.09). Furthermore, using the decision aid during a consultation significantly increased the length of this consultation (t= -5.47; df=7.27; P<.001).The results showed no statistically significant effect on SDM-Q-9 scores (r=-.12, with digital decision aid mean score = 48.8 (+/- 5.9), without digital decision aid mean score 45.5 (+/- 10.7), p = 0.33)). There were no significant differences on choice evaluation.

Conclusions: This pilot study shows positive effects of the digital decision aid; leading to less intensive aftercare trajectory choices and subsequently lowering hospital costs. However, using the digital decision aid during a consultation significantly increases the consultation length.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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2. Developing a parent-targeted online intervention to improve primary care utilisation using real time paediatric respiratory tract infection surveillance data

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Rationale: Respiratory tract infections (RTIs) are one of the main reasons for paediatric primary care consultations and prescription of antibiotics for children. An online intervention combining real-time microbiological and syndromic surveillance data and symptom duration information may reduce unnecessary primary care visits for self-limiting, low-risk RTIs.

Aims: This study aimed to develop a parent-targeted online intervention presenting real-time paediatric RTI surveillance information.

Methodology: Semi-structured interviews (N = 30 mothers) were conducted with parents participating in a wider study evaluating the feasibility of collecting community-based RTI surveillance information. Interviews explored parents' views on the content, design and potential impact of surveillance information on home care and primary care help seeking. Participants were selected purposefully based on deprivation (index of multiple deprivation decile), child age and whether RTI symptoms had been reported in the feasibility study. During the interviews, participants were presented with examples of the intervention, including locally relevant real- time RTI surveillance and symptom duration information.

Analysis: The interviews were transcribed and analysed using framework analysis. The first three interviews were independently double coded and the study team met regularly to discuss the data interpretation. Using the interview findings and other relevant evidence from previous studies, potential pathways of influence of an online intervention on parents' behaviour were modelled to decide on relevant intervention components. A logic model was developed using the COM-B framework, which accounts for parents' capability, opportunity and motivation for the target behaviours: caring appropriately for a child with an RTI and avoiding unnecessary primary care visits.

Results: The majority of parents were interested in using the online information. Proposed impacts of the information included: identifying the RTI likely to be causing child symptoms and informing judgements about when to seek primary care help. Alternatively, some parents anticipated minimal impact on approaches to caring for children due to parent reluctance to consult primary care for RTI symptoms and confidence in providing home care. Some parents reported that information on circulating RTIs and symptom duration may reassure parents and reduce parent concern by enabling child symptoms to be labelled as a circulating RTI, increasing awareness of how long symptoms are likely to last and informing them that symptoms are prevalent locally. Increased parent concern due to heightened awareness of circulating RTIs and perceived RTI severity were proposed as potential negative consequences by others. Parents stressed the importance of providing further guidance on caring for children in addition to information on circulating RTIs. In response to parent interviews the online intervention will include information on: common locally circulating RTIs, their symptoms and symptom duration; how to care for a child with an RTI; and when to seek primary care help. This should increase parents' knowledge and skills to care for their child (capability) and change their beliefs about their child's condition and beliefs in their self-care capabilities, reducing concerns (motivation). In combination with referring parents to further resources and creating a social norm of caring for children with RTIs at home (opportunity), this should increase the likelihood of home care and reduce unnecessary primary care visits.

Conclusions: Parent-targeted online interventions using real-time RTI surveillance data, symptom duration and home care advice could improve the management of paediatric RTI and reduce consultations and antibiotic prescribing for children with RTI. The developed intervention will be tested in a future online experimental study.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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3. Using digital psychosocial support groups to increase adherence behaviour among HIV positive adolescents in South Africa

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Rationale: One of the biggest challenges for adolescents living with HIV/AIDS (ALWHA) is adherence to Anti-Retroviral Treatment (ART) medication. Based on the strong evidence that various social, emotional and psychological factors can have a significant impact on adherence, the SHM Foundation developed project Khuluma, a pioneering support group model that provides psychosocial support to closed groups of 10-15 ALWHA via text-message. By leveraging the enabling power of digital technologies to provide immediate, anonymous and accessible social support, Khuluma has the potential to positively influence the behaviour of ALWHA associated with adherence to ART.

Aims: To determine the impact of mobile phone peer-to-peer support groups on behaviour associated with adherence to ART medication.

Methodology: Between November 2013 and March 2015, three sets of three-month-long experimental studies were conducted in South Africa. A total number of 99 HIV positive adolescents were recruited from HIV clinics in Pretoria and in Cape Town. Participants were assigned to groups depending on their age and gender, to ensure that they were of a similar age and that there was a good mix of gender in each group. Over three months, participants could freely communicate with one another along with a facilitator and guest speakers. Topics discussed included nutrition, life skills, sexual risk behaviour, HIV knowledge and social stigma.

Analysis: In collaboration with Yale University, University of Pretoria and the University of Cape Town an evaluation methodology was developed underpinned by the information-motivation-behavioural skills (IMB) model. This assessed changes in the adherence to medication before, during and after participation in the support groups. To facilitate the analysis, a questionnaire was administered before and after the the intervention.
Instruments used included the following:

- Internalised stigma was measure using a revised version of the Berger Stigma Scale. Participants were asked to either agree, disagree or indicate a neutral opinion on a series of statements.
- Perceived levels of social support were measured using the Multidimensional Measure of Perceived Social Support. This measure uses a likert-scale response format.
- Self-reported adherence was analysed through a comparison of self-reported pre and post incidence of adherence, and qualitative text message analysis on all terms related to adherence.

Results: The programme has seen 65 male and 34 female participants, who sent over 40 000 text messages. The mobile phone support group provided participants an immediate and anonymous space, thereby enabling them to be honest about whether or not they were sticking to their medication. Hence, the digital space became a tool for behaviour change. Findings indicated that participants reminded each other to take their medication, and shared strategies for dealing with side-effects and how to go about integrating a treatment regimen into their usual routine.
Data showed:

- 6.8% increase in perceived social support
- 25.8% decrease in the levels of internalised social stigma
- 17.4% increase in the levels of self-reported medical adherence.

Conclusions: Mobile phone peer-to-peer support groups can create a space for behaviour change. The human interaction of the support group in a digital environment can leads to positive mental health outcomes (internalised social stigma, perceived social support) that can consequently improve adherence outcomes. Khuluma provides valuable insight into the reasons why ALWHA may or may not be taking their medication, that can provide invaluable information for the development of future behaviour change strategies.

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4. Internet of Things in Healthcare: Identifying key malicious threats, end-user protective and problematic behaviours

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Background: The Internet of Things (IoT) will revolutionise digital health by enhancing users' ability to manage their wellbeing, fitness and health through wearable technology that can provide real time, tailored feedback. These devices can provide valuable data that can enhance diagnosis, patient monitoring and interaction between patients and health care professionals. However, along with the potential benefits, there are unaddressed concerns around the security and privacy of sensitive health information stored on IoT devices, and around the physical safety of users of these devices. In conventional computing it is well established how users can protect themselves against cyber-threats. In the context of IoT however, there is a lack of understanding of key protective behaviours users can perform to protect their security, privacy and safety. This study aimed to establish expert consensus concerning the 1) key malicious IoT threats, 2) key protective behaviours for users to safeguard themselves in IoT environments, and 3) key problematic user behaviours that may undermine cyber hygiene in IoT environments.

Method: The study adopted a multi-phase Delphi design with a panel of information security/IoT experts across three phases. In phase one experts answered open-ended questions relating to IoT threats, protective and risky user behaviours. Responses were coded into broad hygiene categories using content analysis by two researchers. The average inter-rater reliability was k=.70. In phases two and three, experts rated each identified behaviour on their importance, ease of implementation and how time consuming the behaviour is to perform, using 7 point Likert scales ranging from strongly disagree to strongly agree. They also assessed the likelihood of threats and problematic behaviours leading to a successful breach using a scale from 0-100. In phase three participants were also able to re-evaluate their original responses in light of panel scores.

Results: Findings indicated that users need to engage in protective actions across IoT lifecycles from purchase, set-up and maintenance, to device disposal. We found that the top three hygiene categories most discussed by our panel were: credential management behaviours (e.g. use strong passwords), privacy-protective actions (e.g. limit sharing of personal information) and network security (e.g. isolating IoT devices onto their own network). Problematic behaviours included not engaging in protective actions, circumventing security protocols and doing risky actions that leave users vulnerable to attack. For threats, conventional attacks (such as social engineering and denial of service) attacks were considered to continue to be prevalent in IoT, as well as, newer focus of attack vectors (such as counterfeit IoT devices) that comprise security, privacy and safety.

Conclusion: There was consensus on the need to consider behaviours across IoT lifecycles. By considering behaviour across each lifecycle, we have been able to identify key behaviours that users need to adopt when using IoT healthcare devices. Furthermore, we have been able to identify key threats that can, for example, put users' sensitive health information at risk and problematic behaviours that may lead users to be at risk of a successful attack.

5. Can a short interactive communication scenario in virtual reality alter future clinician behaviour to reduce unnecessary antibiotic prescribing in General Practice?

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Objectives: To discuss the possibility that a short interactive communication scenario in virtual reality might alter the future behaviour of a professional in a clinical consultation.

Rationale: Virtual Reality has been all over the news these days. However, few people truly understand virtual technology and more importantly, the implications of how virtual reality could revolutionise the way we interact with the world and each other. Is the use of virtual reality in training useful? Justified? One size fits all? Or just of the moment and sexy? We want to discuss this using our published work showcasing a complicated communications scenario for General Practitioners (GPs).

Background: Our studies explores the extent to which portable Immersive Virtual Reality Technology can help us gain an accurate understanding of the factors that influence a doctor's response to an ethical dilemma. We focused on the relatively simple dilemma underlying tenacious calls for antibiotics given the threat posed by growing anti-bacterial resistance worldwide and heavy investment in antibiotic stewardship. Aside from exploring the potential of virtual reality technology as a training tool, the specific purposes of our study are twofold: first, to investigate whether medical doctors would take the virtual situation seriously which they did and second, whether experienced GPs would be more resistant to patient demands than the trainees which they were.
A short video demonstrating the work can be seen here. https://www.youtube.com/watch?v=C8Hs6NxtXB8 (1)

Focus of contributors approach: We have drawn together a team of experts from a number of fields to debate this issue. Can medical training benefit from using virtual reality? Is the scenario realistic enough to be rolled out nationally to provide training in this area? Will all those who undergo this training be able to show how they have put the lessons learned into the clinical consultation? The experts debating have backgrounds in virtual reality, general practice, medicines management, medical education and training, ethicists and philosophers. We would expect there to be a fair amount of discussion and possible disagreement as to the utility of using virtual reality to train medical professionals in having difficult clinical consultations where the needs of the patient apparent benefit may be overridden by the need to consider the harms to society.

Speaker biographies:
Dr Sylvie Delacroix is a Reader in legal theory and ethics in UCL Laws. She received her PhD from the University of Cambridge, followed by a one year post-doc in Trinity College, Cambridge. In 2010 she was awarded a Philip Leverhulme Prize to pursue her research on the intersection between law and ethics. She was the founding director of the UCL Centre for Ethics and Law. She is the principal investigator of a multi-disciplinary research project —"Picking up ethical challenges within the humdrum of professional practice: can 3D avatars help?" that relies on immersive virtual reality technology to gain a better understanding of ethical decisions in a professional context.

Dr Xueni Pan is a Lecturer in Virtual Reality at Goldsmiths, University of London and an honorary research fellow at the Institute of Cognitive Neuroscience, University College London. She holds a PhD in virtual reality, and an MSc degree in computer graphics, both at UCL. Over the past ten years she developed a unique interdisciplinary research background with journal and conference publications in both virtual reality technology and social neuroscience. Her work has been featured in the media, including BBC Horizon and the New Scientist magazine.

Dr Carmel Sher is a General Practitioner and Partner in the Heron Practice in Stoke Newington, London. She qualified from Nottingham University in 1993 and has attained membership of the Royal College of GPs, Royal College of Physicians and Royal College of Paediatrics and Child Health. She is currently the practice lead for medicines management and anticoagulation at the Heron Practice which has a registered population of 11500.

Dr Sophie Lumley graduated from Birmingham in 2014 with an MBChB and intercalation in Healthcare Ethics and Law. During her time and Birmingham she was President of the Medical Student Society (MedSoc) and throughout her medical school years she was heavily involved in Medical education; in teaching, examining, curriculum development and education research. She has just completed her academic foundation year 2 in Birmingham and is now on a National Medical Directors Clinical Fellowship at NHS England in London.

Ai-Nee Lim is a Consultant Pharmacist in Antimicrobials at the Whittington Hospital. She graduated with a BPharm from the School of Pharmacy, University of London in 1999 and has an MSc in Infection Management for Pharmacists from Imperial College London. She is involved in the training for medical and pharmacy students from the University College London, and has been leading on the training and development the hospital workforce in antimicrobial stewardship for over 10 years.

Facilitator Biography:
Dr Caroline Fertleman has been a Consultant Paediatrician at the Whittington Hospital & an Honorary Senior Lecturer, UCL medical school for 10 years. She is the course co-director for the only iBSc in Paediatrics and Child Health in the UK and is the sub-dean for the Whittington Campus for UCL. Caroline is a widely sought after speaker and chair for educational meetings and conferences locally, nationally and internationally. She is the convenor of her college (RCPCH) education special interest group, a council member and fellow of the Academy of Medical Education and a senior fellow of the Higher Education Academy. She has also authored seven parenting books for the lay public on babies, toddlers and potty training and several textbooks including one which won the paediatric prize in the BMA book awards 2015.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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6. Design and rationale of an innovative intervention addressing inadequate vegetable intake among young adults using social media and mobile gaming

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Rationale: Australian Dietary Guidelines recommend five servings of vegetables daily for prevention of chronic disease. Our secondary analysis of the 2011-12 National Nutrition and Physical Activity Survey data showed 18-24 year-old adults were the poorest consumers, with a mean (SD) intake of 2.7 serves (±3.2) daily. Although national campaigns have attempted to address this problem they have not specifically targeted young adults. Young adults typically live in the present moment so campaigns that use long term chronic disease as a source of extrinsic motivation fail to engage them. Novel approaches to improving vegetable consumption are required. The increased popularity of social media and mobile-gaming among young adults provides an opportunity for an innovative and age-appropriate intervention.

Aims: This body of work aimed to translate findings from our comprehensive literature reviews on the use of mobile-phone technology in nutrition programs to an evidenced- based intervention for improving vegetable intake in young adults. Objectives included the use of formative evaluation to guide iterative development of a user-centered design that addresses key barriers to, and psychosocial determinants of vegetable intake.

Methodology: Review of the literature was guided by the Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA). Scientific databases, Information Technology conference proceedings, and grey literature were searched. Two reviewers conducted screening, data-extraction, and quality assessments. Findings helped to inform the intervention design. The COM-B framework was used for the development of age-appropriate intervention materials to be tested through focus groups and think-aloud interviews.

Results: Existing studies using social media and mobile-gaming were found to promote improvements in nutrition outcomes such as knowledge and attitudes. The pooled effect of electronic interventions directly targeting vegetable intake was 0.15 (Cohen's d), 95% CI 0.04– 0.28. Behaviour change techniques which supported improvements included goal setting, self-monitoring and provision of tailored feedback. An app for goal setting and self-monitoring of vegetable intake was developed alongside experts in human computer interaction from the School of Information Technology at The University of Sydney. It included gamification features and feedback push notifications for use alongside a Facebook intervention which provides real-time social support and educational materials that address the barriers to vegetable intake relevant to this age group, such as short cooking videos to enhance cooking literacy. Focus group testing has confirmed the acceptability of these materials. Think-aloud interviews will be used in the final stages of iterative app design prior to trialing the proposed intervention in a randomised controlled study in early 2017.

Conclusion: The development of this novel and age-appropriate intervention employed a best practice approach, including review of existing studies, contributions from a multidisciplinary team and grounding in behaviour change theory. Preliminary testing with end users has indicated positive support. If effective, this technology could allow for the widespread dissemination of a vegetable intervention in a low-cost, accessible and engaging manner.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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7. The efficacy of the Friendly Attac serious digital game to promote prosocial bystander behavior in cyberbullying among young adolescents: a cluster- randomized controlled trial

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Introduction: Cyberbullying is a social phenomenon which can bring severe harm to victims. Bystanders can show positive bystander behavior (e.g. defending) and decrease cyberbullying and its harm, or negative behavior (e.g. passive bystanding, joining) and sustain cyberbullying and its negative effects. Few interventions have currently targeted bystanders and evaluated results on their behavior or its determinants.

Method: The intervention consisted of a serious game specifically targeting cyberbullying bystander behavior. Intervention development followed the Intervention Mapping protocol. Translation of selected behavior change techniques in the gameplay was iteratively tested by independent behavior change experts, and adjusted where not sufficiently present. A cluster-randomized controlled trial was conducted among 8th graders (n=216) in two schools. Measurements were taken at baseline, immediately after the intervention and at 4-week follow- up.

Results: The serious game intervention resulted in significant improvements in self-efficacy, prosocial skills, and the intention to act as a positive bystander. These are mainly predictors of positive bystander behavior. No significant effects were found for predictors of negative bystander behavior. The intervention also increased witnessing of cyberbullying incidents, potentially a measure of awareness of cyberbullying taking place, and quality of life. No effects were found on behavior itself, bullying or cyberbullying prevalence.

Discussion: This brief serious game intervention affected determinants of bystander behavior and quality of life among adolescents. Further efforts and adaptations are needed to address (negative) bystander behavior and cyberbullying involvement.

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8.   Can games help you get better? Experimental evidence on adherence behaviour from Pakistan

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Rationale: Non-adherence to antibiotic medication is one of the contributing factors towards increasing antimicrobial resistance, and also reduces the effectiveness of the medications for individual patients. Despite this, research show this non-adherence is typically as high as 50%. Consequently, the most recent systematic review on medication adherence states that, "increasing the effectiveness of adherence interventions may have a far greater impact on the health of the population than any improvement in specific medical treatments". In line with this, the Medical Research Council in the UK has proposed that the development of a behavioural intervention should follow the same cycle as drug development - a theory behind the design of behavioural intervention, followed by modelling of the problem or behaviour, then an exploratory trial and finally a RCT and implementation of the intervention.

Aims: To develop an experimental simulation of medication adherence that accurately models the adherence and non-adherence behaviour of patients taking antibiotics and can serve as a platform that allows testing various behavioural interventions and principles and determine what works and what doesn't which then feeds into the development of an RCT.

Methodology: A nationally representative survey (n=1892) was carried out administering the Morisky's Medication Adherence Scale to determine the extent of adherence among Pakistani population. This served as a benchmark to compare for the control group in the lab experiment. Next, the Theoretical Domains Framework (TDF) was used to identify barriers to medication adherence among the Pakistani population which guided the development of theory-informed interventions that were tested in the lab. A nationally representative survey (n=1686) was then carried out to understand the communication that takes place between doctor and patient at the time of antibiotic prescription. This communication was mimicked in the lab experiment. The lab experiment involved using a popular and addictive video game (2048). The game was the lab analogue of "everyday life." Participants were rewarded based on how well they did in the game. To simulate the onset of illness, the game was

modified so that at the start of a session the screen was blurred, making it very difficult to play the game. To simulate the use of medication, they were given a code which they entered every minute to clear up the screen. The screen became clearer each time the code was entered. However, halfway through, the screen became clear while the participants were still expected to enter the code. If the code was not entered they could "relapse" and the screen became blurry again. The study comprised of control group (n=104) and 4 treatment arms: Incentives (participants were rewarded with Rs.5 on every correct code entry, n=106); Reminders (message on the screen every time code was due, n=97); Commitment device (participants signed a pledge before the start of the game to enter the code, n=66) and Elongated Symptoms (it took twice as long for the screen to become clear, n=100).

Analysis: Planned comparisons (ANOVA) were carried out to determine significant changes in adherence rates between the control group and treatment groups.

Results: The adherence rate in the control group was 44%. Reminders improved the adherence significantly by 23% (p=0.000). Elongated Symptoms improved the adherence significantly by 10% (p=0.018). Incentives improved the adherence significantly by 8% (p=0.047). A commitment device did not improve adherence.

Conclusions: The adherence rate found in the lab control group closely matched that in the real setting. Furthermore, it is known that incentives and reminders improve adherence which has been validated in the experiment. At the time when the experiment was carried out, a large-scale RCT was carried out in the UK using the same commitment device that was adopted in the experiment. This commitment device failed to improve adherence rates significantly in the RCT as has been the prediction of the lab experiment. The last treatment group of Elongated Symptoms really shows the power of modelling experiment where we test a what-if scenario that is extremely difficult to test in an RCT setting owing to ethical concerns. The results from the experiment provide a proof of concept that if symptoms last longer people adhere more to their medication regimen. Lab experiments are not widely carried out in Pakistan. Using a game in the experiment proved to be a very important factor in attracting participants, and greatly improved their engagement. Lab based modelling approach can be very beneficial in the development of a behavioural intervention. Firstly, it is much cheaper to carry out than testing all interventions right away in the field. It is much quicker in terms of getting results and easier for ethics approval. Lastly, it allows intervention designer to test many 'what if' questions, identify the most effective interventions or principles and then proceed to a well-informed RCT.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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9. The effects of individual game mechanics and web- based testing on cognitive test performance and participant enjoyment

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Rationale: Computerised cognitive assessments are a vital tool in the behavioural sciences, but participants often view them as effortful and unengaging. One potential solution is to add gamelike elements to these tasks in order to make them more intrinsically enjoyable, and some researchers have posited that a more engaging task might produce higher quality data or reduce participant attrition from a longitudinal study. Here, we present two studies into the effects of individual game mechanics on the data and enjoyment ratings of two cognitive tasks designed to measure inhibitory control.

Aims: In study 1 we investigated the effects of gamelike features and test location on the data and enjoyment ratings from a Go-NoGo task. In study 2 we further investigated the effects of gamelike features on participant attrition from a 10-day longitudinal testing programme using a Stop Signal Task.

Methodology: In both studies, we tested three variants of the tasks between participants: one in which participants were rewarded with points for performing optimally, one where the task was given an overall theme and graphical upgrade, and a third version which was a non-gamified comparator. Study 1 was conducted both online and in the laboratory in order that we might compare results between the two sites. Study 2 was conducted online only, however it was of a longitudinal format, with 4 to 10 sessions of assessment for each participant. We assessed differences in inhibitory control measures between task variants. In study 2 we also assessed differences in participant attrition from each variant, and investigated whether subjective and objective measures of engagement changed over time.

Results: We found points to be a highly suitable game mechanic for gamified cognitive testing because they did not disrupt the validity of the data collected but increased participant enjoyment. However, we found no evidence that gamelike features could increase engagement to the point where participant performance improved. We also found that while participants enjoyed the themed task, the difficulty of categorising the gamelike stimuli adversely affected participant performance. Responses collected online vs. in the laboratory had slightly longer reaction times but were otherwise very similar, supporting other findings that online crowdsourcing is an acceptable method of data collection for this type of research.

Conclusions: The addition of game mechanics to cognitive tasks does seem to have potential for increasing participant engagement. Points appear particularly effective and additionally do not disrupt task validity. However, more complex gamelike features such as graphical theming may have unwanted effects of data and should be investigated further.

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10. The Human Behaviour Change Project: Digitising the knowledge base on effectiveness of behaviour change interventions

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Rationale: Intervention developers, researchers, policy-makers and practitioners need access to the best available evidence on what interventions work, compared with what, how well, for what behaviours, for whom, in what settings and why. Evidence about behaviour change interventions, including digital interventions, is currently being produced much more rapidly than humans can identify, read and process. It is also being reported in ways that limit our ability to synthesise it to draw generalisable conclusions. This limits advances in our understanding of behaviour change and our ability to design more effective interventions.

Aim: This presentation describes the initial phase of The Human Behaviour Change Project, which will harness the potential of digital technologies to advance our understanding of behaviour change. This first phase will develop an 'ontology' (a formal structure for organising knowledge in terms of defined constructs and their relationships) of behaviour change intervention (BCI) evaluations and develop a natural language processing (NLP) system to populate the ontology by automatically extracting and organising information from published research reports. These constitute part of a major project,

Methods: The project involves a collaboration of behavioural, computer and information scientists in an iterative process.

Behavioural and information scientists will lead on building an international consensus around an ontology of BCIs that captures, for each evaluation, information on: 1) interventions and comparators: features of content, delivery, and exposure, 2) behavioural targets: types of behaviour change and how they are operationalized, 3) context: features of study samples

and settings, 4) putative mechanisms of action: proposed logic models of the interventions, 5) effect sizes, and 6) features of the evaluation needed for weighting and bias estimates.

Computer and information scientists will lead on building an NLP system to extract information from published research reports of BCI evaluations to populate and extend the ontology. This will draw on, and extend, technology developed by IBM Research to extract information from unstructured text in a variety of domains.

Outputs: This is intended to be an ongoing programme of work so that outputs will be continually generated and updated. The initial outputs will be: an international consortium of behavioural scientists engaged with the mission of building and using the BCI ontology, the first full version of a formal BCI ontology, an annotation tool to allow users to manually extract features of BCI evaluation reports to populate the ontology, an NLP system to automate as far as is practicable the process of feature extraction, and a populated ontology that can be searched and processed to access and synthesise key findings. This will provide the basis for the next phase, a Machine Learning system to synthesise evidence in the populated ontology to create knowledge about behaviour change; and an interface allowing users to interrogate and update the knowledge structure and evidence base.

Conclusions: This collaboration between behavioural, computer and information scientists has the potential to make a step-change in the accessibility and value of information about BCIs, and provide an important resource for digital intervention developers, researchers, policy-makers and practitioners.

Conflict of Interest: PM is employed by IBM, SM is Director of UCL's Centre for Behaviour Change which has received funds from industry and government agencies and RW has undertaken research and consultancy for, and received travel funds from, companies that develop and manufacture smoking cessation medications (Pfizer, GSK and J&J). His salary is funded by Cancer Research UK.

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11. Digital Behaviour Change Interventions through a Web Browser Extension to Improve Learners' Retention

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Rationale: One of the most significant and recent changes in education is the popularity of massive open online courses (MOOCs). The concept of MOOCs allows instructors to deliver educational content online at an unprecedented mass level. An MOOC as an innovative form of learning, despite its benefits also has a limitation – a high percentages of dropouts. The median of 'completers' of a MOOC is 12.6% (1). Furthermore, learners who have successfully completed a MOOC ('completing' learners) have specific features in common, and outsiders ('at-risk' learners) have specific features that characterise them. If these features are known, it is possible to identify and predict with high probability 'at-risk' learners as well as those who are more likely to complete a chosen course (2–4). Research evidence reports a number of solutions applied to improve learners' retention, including interventions with Android Wear (5), Teacherbots (6), and self-regulated learning strategies (7). The present research project tests an innovative solution to decrease dropout rates by applying digital behaviour change interventions through a web browser extension. A browser extension is a plug-in that extends the functionality of a web browser, allows one to collect information about users' web sessions, and makes interactions by sending pop-up notifications.

Aims: The main goal of this research project is to increase learner's engagement with MOOCs and decrease dropout rates. The research hypothesis is based on the assumption that it is possible to improve learners' retention on MOOCs through personalised, digital behaviour change interventions.

Methodology: This research project applies mixed research methods approach, including the collection of digital footprints and questionnaires. Participants are randomly allocated to control and intervention groups. Participants who installed the browser extension are asked to complete a survey before participating in this study. This survey consists questions related to participants' willingness to complete the chosen course, their motives, prior knowledge, future expectations, and their socio-demographic data. Learners who are participating in this study are asked to give permission for collecting information about their browsing sessions such as visited websites, opened tabs, and time of activity or inactivity on each website. This data is associated with each student's unique identification number and used for dividing learners into clusters and generating interventions through the browser extension. Interventions are designed, evaluated, selected, and applied by using the Behaviour Change Wheel framework (Michie, Atkins, & West, 2014) and Taxonomy of Behaviour Change Techniques (9).

Analysis: This research project involves the use of learning analytics and behaviour change intervention techniques. For the purpose of clustering learners and constructing a predictive model to identify at-risk learners, supervised and unsupervised machine learning methods are applied. The evaluation of applied interventions is analysed by using Bayesian statistics methods.

Conclusion: The use of digital behaviour change interventions to improve learners' retention may be an effective solution to decrease the dropout rate and increase learners' outcomes on MOOCs.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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12. Beyond the Randomized Controlled Trial: A Review of Alternatives in mHealth Clinical Trial Methods

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Rationale: Randomized controlled trials (RCTs) have long been considered the primary research study design capable of eliciting causal relationships between health interventions and consequent outcomes. However, with a prolonged duration from recruitment to publication, high-cost trial implementation, and a rigid trial protocol, RCTs are perceived as an impractical evaluation methodology for most mHealth apps.

Aims: Given the recent development of alternative evaluation methodologies and tools to automate mHealth research, we sought to determine the breadth of these methods and the extent that they were being used in clinical trials.

Methodology: We conducted a review of the ClinicalTrials.gov registry to identify and examine current clinical trials involving mHealth apps and retrieved relevant trials registered between November 2014 and November 2015.

Analysis: Descriptive statistics were conducted on all variables to identify methodological data trends and parameters. Independent t tests, one-way ANOVAs and Pearson correlation analyses were conducted to determine whether there were differences in study duration for all methodological variables. A multiple linear regression analysis was performed with study duration as the dependent variable and all significant predictor variables from the preliminary analyses as independent variables.

Results: Of the 137 trials identified, 71 met inclusion criteria. The majority used a randomized controlled trial design (80%, 57/71). Study designs included 36 two-group pretest-posttest control group comparisons (51%, 36/71), 16 posttest-only

control group comparisons (23%, 16/71), 7 one-group pretest-posttest designs (10%, 7/71), 2 one-shot case study designs (3%, 2/71), and 2 static-group comparisons (3%, 2/71). 17 trials included a qualitative component to their methodology (24%, 17/71). Complete trial data collection required 20 months on average to complete (mean 21, SD 12). For trials with a total duration of 2 years or more (31%, 22/71), the average time from recruitment to complete data collection (mean 35 months, SD 10) was 2 years longer than the average time required to collect primary data (mean 11, SD 8). Trials had a moderate sample size of 112 participants. Two trials were conducted online (3%, 2/71) and 7 trials collected data continuously (10%, 7/68). Onsite study implementation was heavily favored (97%, 69/71). Trials with four data collection points had a longer study duration than trials with two data collection points: $F_{4,56}=3.2$, $P=.021$, $\eta2=0.18$. Single-blinded trials had a longer data collection period compared to open trials: $F_{2,58}=3.8$, $P=.028$, $\eta2=0.12$. Academic sponsorship was the most common form of trial funding (73%, 52/71). Trials with academic sponsorship had a longer study duration compared to industry sponsorship: $F_{2,61}=3.7$, $P=.030$, $\eta2=0.11$. Combined, data collection frequency, study masking, sample size, and study sponsorship accounted for 32.6% of the variance in study duration: $F_{4,55}=6.6$, $P<.01$, adjusted $r2=.33$. Only 7 trials had been completed at the time this retrospective review was conducted (10%, 7/71).

Conclusions: mHealth evaluation methodology has not deviated from common methods, despite the need for more relevant and timely evaluations. There is a need for clinical evaluation to keep pace with the level of innovation of mHealth if it is to have meaningful impact in informing payers, providers, policy makers, and patients.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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13. An evaluation of the modalities used to deliver eHealth interventions for chronic pain: Systematic review with Network Meta-Analysis.

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Background: Traditional approaches to interventions for chronic pain are subject to numerous constraints, including, direct and indirect costs, highly labour intensive, long waiting lists, mobility and accessibility issues, and shortages in appropriately trained health care professionals. To negate these limitations, researchers have begun to administer both psychological and non-psychological interventions via various technologies. The objective of the current systematic review and network-meta-analysis (NMA) is to evaluate the various treatment modalities (Internet, telephone etc.) used to deliver interventions for chronic pain.

Methods: A recent Cochrane review of internet delivered interventions for adults with chronic pain forms the basis of the search terms and databases that were used in this review (Eccleston et al 2014). Randomised controlled trials that investigate technologically delivered interventions for adults with chronic pain are included in the study. Two reviewers independently assessed relevant studies to determine whether they satisfied eligibility criteria, extracted data from the selected studies and assessed the risk of bias using the Cochrane Method. A random effects network meta-analysis will created in a Bayesian framework with vague priors. The NMA allows for the developing of indirect comparisons between all modalities and to rank the eHealth modalities in order of their effectiveness at delivering interventions.

Results: The search returned 16,515 studies (CENTRAL: 699, EMBASE: 9,708, MEDLINE: 4,322, PsycINFO: 1786). There were 1,925 papers excluded as duplicates and 14,590 papers excluded based on title and abstract. There were 105 papers were assessed based on full text, 81 papers were excluded (41 non RCT, 12 had n<20 per arm, 5 had cancer pain, 10 did not use a modality, 3 were follow up, 7 did not measure pain outcome) and 24 studies across 9 arms were included in the NMA. Included studies were at a low to moderate risk of bias and the risk of publication bias was low. A random effect NMA was created which

suggested that telephone supported interventions were the most effective, with non-psychological telephone ranked first and psychological telephone interventions ranked second. This was followed by psychological interactive voice response, psychological internet, psychological smartphone, non-psychological internet, control, enhanced control and psychological virtual reality. There was a 33.43% chance that non-psychological telephone was the best modality. Heterogeneity was low with a tau squared of 0.08 and additional covariates did not add significantly to the model.

Discussion: The findings from this study will assist patients and researchers to make informed decisions regarding which modalities deliver more effective interventions for chronic pain. Limitations and broader implications of the research findings will be discussed in detail.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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14. Wrapped: Development and specification of an intervention to increase condom use amongst young people accessing chlamydia self-testing websites

Katie V. Newby[1]*, Julia V. Bailey[2], Rik Crutzen[3], Katherine Brown[1], Ala Szczepura[1], Jonny Hunt[4], Tim Alston[5], John Saunders[6], Tariq Sadiq[7] and Satyajit Das[8]

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Rationale: In England, the Department of Health has made reducing the rates of Sexually Transmitted Infections (STIs) a priority, particularly amongst young people who are disproportionately affected. The best way for sexually active people to avoid STIs is to use a condom but young people report inconsistent use. A missed opportunity to intervene to increase condom use is when they access self-testing kits for STIs via the internet. On average 130,000 young people are tested via this route every year in England. Those tested are at high risk of future STIs and include groups which other services have found difficult to engage, such as young men and those from deprived backgrounds. Typically however, these websites provide little or no sexual health promotion.

Aims: This study aimed to develop a theory-based, tailored intervention to increase condom use for young people aged 15-24 years accessing chlamydia self-testing websites.

Methodology: The intervention (Wrapped) was co-designed with young people to maximise future appeal and use by the target audience. Development followed guidance from the Medical Research Council (MRC) on developing complex behaviour change interventions. The following steps were performed: 1) identification of important determinants of condom use and evidence of their 'changeability' using computer/digital interventions, 2) identification of suitable Behaviour Change Techniques (BCTs), and engaging methods of delivery, to target these determinants , 3) design of the tailored intervention ensuring fidelity to theoretical basis and high levels of appeal/usability.

Analysis: Not applicable

Results: The resulting intervention is to be embedded within existing chlamydia self-testing websites as part of the user pathway. It uses a 'recommender system' to identify users' salient barriers to condom use and to present relevant components of the intervention to target these. Components are delivered over a period of days in between the request for a chlamydia

self- testing kit and provision of the result. The components include: provision of a selection of condoms/lubricant and instructions for identifying preferred type(s), easy access to preferred condom(s)/lubricant through a discrete delivery service, video demonstration of eroticized condom application, real sex videos showing condom use, talking heads of other young people discussing how to communicate wish to use condoms, and provision of condom storage/carrying product.

Conclusions: this tailored intervention will be directed at young people who may be particularly receptive to messages and support for behaviour change due to their testing status. The content of this intervention makes a deliberate attempt to target cognitive processes relating to both system one (emotional, instinctive, responds to needs – basic urges and drives) and two (analytical, controlled, rational, can plan ahead). Next steps are to run a feasibility study and then a full trial of the intervention to establish its efficacy.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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15. Changing Children's Choices; investigating the effects of food-specific inhibitory control training on healthy food choice amongst children

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Rationale: Around one-fifth of children leave primary school obese. Healthy-eating interventions typically rely upon self-regulation (e.g., impulse control). However, brain areas associated with such control are immature in childhood. Training children to inhibit motor-responses (keyboard presses) to energy-dense (ED) food pictures in a computerised go/no-go task may help children to develop impulse control abilities and has led to reduced choice and intake of ED foods relative to control groups. However this effect has not always been replicated. An absence of baseline measures has prevented researchers from understanding whether past results are due to changes in the active (trained) condition or artefact effects in control groups.

Aims: To investigate the effect of food-specific go/no-go training on changing children's food choices from baseline to post-training, compared to two commonly used control tasks.

Methodology: Eighty-one children aged 4-11 took part in this study. At baseline, children chose six (out of twelve) foods shown on cards. They were informed they would be given some of these foods to eat later in the study. We measured how many healthy food-cards (relative to unhealthy) children chose out of a maximum of six. The training phase took place at least one week later. Children played one of three go/no-go games. In the active task, healthy food images were paired with Go-signals and ED-food images were paired with No-Go-signals. In the food-control task, all food images were paired equally with both signals. In the non-food-control task, sports equipment images were paired with Go-signals and technology images were paired with No-Go- signals. Children then repeated the food-card choice task. Finally, a real-food choice measure was piloted, with children choosing three (out of six) foods as a participation reward.

Analysis: The effect of condition on healthy food-card choice was investigated with an ANCOVA controlling for baseline choice. Change in healthy food-card choice was examined using t-tests for each condition separately. The correlation between food-card choices and real-food choices was investigated and a Kruskal-Wallis test examined the effect of condition on real-food choice.

Results: The effect of condition was significant (p = .007) with children in the active task choosing more healthy food-cards (M = 3, SE = .20) than children in the food-control (M = 2.25, SE = .22, p = .036) and non-food-control (M = 2.14, SE = .21, p = .012) conditions. The difference between the control groups was not significant. Change from baseline to post-training was significant in the active group (t28 = -4.79, p < .001) but not in either control group. Food-card and real-food choices correlated significantly (rs = .66, p < .001) however, condition did not significantly affect real-food choice.

Conclusion: The effects of food-specific go/no-go training on food choice are due to increases in healthy food selection (relative to unhealthy) in the active condition, rather than changes in either of the commonly used control tasks. This may extend to real-life eating behaviour change in children however this conclusion is tentative due to the absence of a sensitive measure of food intake in this study.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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16. Sustainably increasing water intake in adults and children: behavioral interventions combining a web-based program and environmental change

Sabine Boesen Mariani[1*], Jeanne Bottin[2], Isabelle Guelinckx[2], Marie-Agnes Beetschen[1] and Saadi Lahlou[3]

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Objectives: Insufficient total fluid intake (TFI; sum of plain water and all other fluids) remain a significant public health issue in many developed countries for adults & children. The objective of our research is to assess the impact of an multi-component intervention based on Installation Theory, combining information (a web-based education program), affordances (free water bottles delivery at home), and social regulation (online forum) on plain water intake over a 12 months period in real life conditions, across targets and countries.

Methods: We have conducted 2 studies. In the first, 178 French women with mean TFI < 1,2L/d were enrolled in an 2-phase environmental intervention. In Phase 1 (4 weeks in duration), all participants received home deliveries of bottled water. In Phase 2 (4 months in duration), only participants who showed low water intake increase continued to receive home deliveries of bottled water and were also enrolled in the web-based information program. TFI was assessed at baseline, 2, 6 and 12 months. In the second study, 334 preschool Polish children were allocated to 3 interventions: Control (no intervention), Information (INFO; online education sessions on water related health benefits and cues to action for parents), Information + Water Affordance (INFO+W; online education sessions and home delivery of water). After 3 months, half of the INFO and INFO+W subjects were randomly assigned to Social Regulation (+SOCIAL) (on-line discussion forum) or no further intervention (-SOCIAL). TFI of the children was recorded by the carers 6 times over a one-year period. Both studies assessed TFI with an online 7-day fluid-specific dietary record.

Results: In the first study, plain water intake increased 1.5 times (+499 mL; P<0.001) in Phase 1. In Phase 2, participants who showed a low water intake increase in Phase 1 (0.5 times; +192 mL) increased their intake 1.5 times (+540 mL; P<0.001) compared with the baseline and reached the same intake level (P=0.58) as participants who exhibited a high water intake increase in Phase 1 (2.7 times; +598 mL; P<0.001). The significant 1.6 time increase in plain water intake (+ 538 mL; P<0.001) still occurred over 12 months in the total sample. Over 1 year, all groups significantly increased water consumption by 3.0 to 7.8 times (+118 to +222 mL). The interventions had different effects. INFO+W+SOCIAL and INFO-SOCIAL generated the highest increase in plain water intake after one year compared to baseline, by 7.8 times (+216 mL) and 6.7 times (+222 mL) respectively, and both significantly exceeded the CONTROL (3.0 times, +118 mL), whilst the effect of INFO+W-SOCIAL (5.0 times, +158 mL) and INFO+SOCIAL (5.3 times, +198 mL) did not differ from that of the CONTROL. A secondary observation made was that all interventions also led to a decrease of sweetened beverages intake, again with INFO+W+SOCIAL generating the largest decrease (-27%; -172 mL).

Conclusions: Both studies indicated that a multi-component intervention can sustainably increase plain water intake in real life conditions among both adults and children.

Conflict of Interest: Danone Nutricia Research payed for the study (data collection and data analysis).

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17. Impact of a 35-month radio campaign addressing key lifesaving family behaviours for child survival in rural Burkina Faso: Results from a cluster randomised trial

Joanna Murray[1]*

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Background: In Burkina Faso, a cluster randomised controlled trial has evaluated a comprehensive 35-month radio campaign addressing key behaviours for improving child survival. The primary objective was to investigate whether the intervention could change behaviours, resulting in measurable reductions in post-neonatal, under-five child mortality.

Methods: From fourteen community radio stations seven were randomly allocated to receive the intervention. At endline full birth histories were collected from 100,000 mothers. Cross- sectional behavioural surveys of 5,000 mothers of children under-five, were conducted at baseline, midline and endline. Routine health facility data were analysed for evidence of changes in utilisation. Statistical analyses were based on cluster-level summaries and adjusted for imbalances between arms at baseline.

Results: At midline and endline, at least 75% of women in the intervention arm reported recognising campaign spots. Post-neonatal child mortality declined by approximately 30% in both arms during the study (risk ratio 1.04 95%CI 0.80-1.33; p=0.77). Routine health facility data showed a 35% greater increase in consultations in the intervention arm compared with the control arm during the first year of the campaign (p<0.001), and a 22% increase in the second (p=0.01) and third years (p=0.04).

Conclusion: This study provides strong evidence that a mass media campaign alone can increase health facility utilization for childhood illness. There was no detectable evidence of impact on child mortality or habitual, preventive behaviours. However, the small number of clusters, substantial between cluster heterogeneity, and rapidly declining mortality, limited the power of the study to detect modest changes in behaviour or mortality.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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18. Changing Health Outcomes in Road Transport

Daniel Campsall[1]* and Rachel Carey[2]

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TOPIC 1: SUSTAINABLY SAFE?

Dr Adrian Davies, Visiting Professor, Transport & Health, UWE

When the ideal transport system is safe, sustainable and active, delivering reduced emissions, increased physical activity and more liveable spaces, why is it so hard to achieve? Understanding the competition that exists between goals for sustainability, safety and public health could be key to ensuring that these allied areas of policy can be converged for public benefit rather than colliding to their shared detriment. The plethora of digital devices for self-monitoring of behaviour is influencing active travel choices, but far can the digital environment go in helping address safe switching to sustainable modes.

TOPIC 2: KNEE DEEP IN DATA, LACKING INSIGHT

Deirdre O'Reilly, Head of Social Research, Highways England

The nature of transport is that it generates a huge amount of data, but often does not translate this well into behavioural insight which can, in turn, be utilised to produce well designed, evidence based behavioural change initiative. A second challenge that transport can face is that the evidence base does not always align with the expectations of allied professionals, especially those from the health sector. RCTs are relatively infrequent as an experimental design in road transport, but that does not mean that the evidence base is unreliable; digital interventions such as hazard perception testing or telematics insurance generate millions of data points but how much behavioural insight? This presentation aims to ask how an important sector such as road transport can take its place alongside public health partners and develop capacity in behavioural change practice.

TOPIC 3: HARM OR HELP; ROAD USERS AND THEIR DIGITAL WORLDS

Dan Campsall, Director, Road Safety Analysis

The digital realm is pervading road transport with increasing speed, but what is the impact on the overall safety of the system? Mobile phone use at the wheel increases cognitive load and impairs driving performance but mobile communications are increasingly pervasive as a built-in feature for new cars. Pedestrians and cyclists are distracted by apps and devices, while the technological solutions to offset this effect have still to mature or prove their potential for greater market penetration. This presentation looks at the some of the digital trends influencing road users, the problems they solve and those they create.

TOPIC 4: COLLISION COURSE – THE IMPACT OF TECHNOLOGICAL INNOVATION ON HUMAN BEHAVIOUR

Professor Oliver Carsten, Institute for Transport Studies, University of Leeds

Autonomous vehicles offer a very different horizon for our transport system where risks are dramatically reduced as driver control is ceded in favour of technology. Looking at the roadmap to full autonomy requires acceptance of a dramatically different relationship between road users and vehicle technology. This presentation examines the behaviour change implications of establishing a new norm for road transport and any indicators of just how hard it might be to get there.

Chair: Dr Rachel Carey, UCL

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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19. Digital Behaviour Change Interventions Aimed at Healthy Eating and Physical Activity: A Population-based Study of Perceived Suitability for Intervention Delivery

Lise Gauvin[1]*, Noemie Ferre[1], Geetanjali Datta[1] and Marie-Hélène Mayrand[1]
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Rationale: Noncommunicable diseases are major causes of morbidity and mortality which could be partially prevented if more individuals adopted healthy eating and physical activity. Behaviour change interventions, both digital and otherwise, support changes but cannot have an impact unless they reach large, representative population segments.

Aims: In a population-based sample of adults, we examined (1) perceived suitability of digital behaviour change interventions over other venues for intervention delivery, and (2) associations between perceived suitability and demographic, socioeconomic, and health characteristics.

Methodology: We conducted an online survey among residents of a large Canadian city (n=1183) during the winter of 2016. Participants were recruited through a polling firm's online panel, accessed a survey via a secured site, and completed an institutional consent form before responding. The survey tapped into self-rated health and respondents identified the three venues they believed to be most suitable for offering high-quality, effective programs aimed at eating and physical activity among: community hospital, university hospital, local community health center, pharmacy, private fitness centre, community sports centre, family health clinic, rehabilitation clinic, nutritionist office/clinic, website, or Apple/Android App. Information about sex, age, education, family income, and country of birth was available for panel respondents.

Analysis: We computed age- and sex-weighted proportions of respondents indicating that digital behaviour change interventions (website or Apple/Android app) were among the three most suitable venues for offering high-quality, effective programs. We performed unweighted, multivariate logistic regression analyses to identify health, demographic, and socioeconomic correlates.

Results: About 42.9% and 38.8% of respondents identified digital behaviour change interventions to be among the three most suitable venues for offering high-quality, effective programs to modify eating habits and physical activity respectively. Multivariate logistic regression analyses showed that being aged 18-24 years (OR=2.46; 95%CI: 1.30, 4.64) or 25-34 years (OR=1.58; 95%CI: 1.02, 2.45) was associated with greater likelihood of identifying digital behaviour change interventions as most suitable for changing eating but having high school education or less (OR=0.48; 95%CI: 0.34, 0.67) and not being born in Canada, the USA, or Western Europe (OR=0.65; 95%CI: 0.42, 1.00) were associated with lower likelihood. Identifying digital behaviour change interventions as being suitable for increasing physical activity was less likely among respondents aged 55-64 years (OR=0.59; 95%CI: 0.41, 0.85) and 65 years and over (OR=0.50; 95%CI: 0.32, 0.78), having a high school diploma or less (OR=0.56; 95%CI: 0.40, 0.78), having a community college degree (OR=0.65; 95%CI: 0.47, 0.89), having an annual family income below $25 000 (OR=0.48; 95%CI: 0.20, 0.62), and not being born in Canada, the USA, or Western Europe (OR=0.40; 95%CI: 0.25, 0.64). Adjusting for demographic and socioeconomic variables, rating one's health as average or poor was associated with lower likelihood of identifying digital behaviour change interventions for increasing physical activity (OR=0.57; 95%CI: 0.41, 0.81).

Conclusion: A substantial population segment prefers digital behaviour change interventions for delivering high quality, effective programs to improve healthy eating and physical activity but preferences are unequally distributed. In implementing and scaling up digital behaviour change interventions, special attention is required to reach entire populations.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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20. Health apps for physical activity: a review and content analysis of the quality of the most popular apps

Paulina Bondaronek[1]*, April Slee[1], Ghadah Alkhaldi[1], Fiona Hamilton[1] and Elizabeth Murray[1]

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Rationale: The benefits of physical activity (PA) on disease prevention are well-documented [1-3]. Within the new digital health care landscape, the rise of health applications (apps) creates novel prospects for behaviour change opportunities [4]. The commercial market is saturated with apps that aim to increase PA. Despite the wide distribution and popularity of PA apps, there are limited data on their effectiveness, user experience, and safety of personal data [5].

Aims: The aim of this review and content analysis was to evaluate the quality of the most popular PA apps on the commercial market, and to explore the association between the quality of the apps and user ratings.

Methodology: The top-ranked 100 free and paid apps in the Health & Fitness categories of iTunes and Google Play stores (total of 400 apps) were screened for inclusion in the analysis. Apps were included if the primary behaviour targeted was PA; targeted users were adults; the apps had stand-alone functionality. The apps are being downloaded on mobile phones and assessed by two reviewers against the following quality assessment criteria: 1) presence of Behavioural Change Techniques (BCTs), 2) usability, 3) safety of personal data. Inter-coder reliability is calculated using Cohen's kappa and prevalence adjusted bias adjusted kappa.

Analysis: Mean and ranges are being calculated for the number of observed BCTs of all the included apps. The relationship between the number of BCTs and average user ratings will be assessed using linear regression and proportional odds models.

Results: Power calculations showed that 100 apps must be evaluated in order to have 80% power to detect a mean change in user ratings of 0.078 for each additional BCT unit with a type-1 error rate of 5%. Data collection and analysis are ongoing and are expected to be finished in November 2016. Preliminary analysis suggests that the apps for PA include, on average, 5.5 BCTs, ranging from 2 to 10.

Conclusions: Health apps aiming to increase PA include on average only 5.5 out of 93 possible BCTs. Despite the popularity of PA apps available on the commercial market, the suboptimal quality of these apps represents a missed opportunity for PA promotion.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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21. Determinants for sustained use of an activity tracker: an observational study among 711 participants in France

Sander Hermsen[1]*, Jonas Moons[1], Peter Kerkhof[2], Carina Wiekens[3] and Martijn de Groot[3]

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Background: One of the biggest threats to our health is physical inactivity, which is considered to cause 6% of deaths globally. Feedback from digital technology, e.g. activity trackers, has the potential to encourage physical activity. However, a crucial ingredient for lasting effects on behaviour change is sustained use of the intervention. Unfortunately, there is as yet little research available on the natural development of use of activity trackers. What little (anecdotal) evidence available, suggests activity trackers may have a poor record when it comes to sustained use, since they are easy to switch off, ignore, lose, or neglect. Furthermore, there is to date little research available that could shed light on potential factors that predict which users manage to keep using their activity tracker during the first year (and thereby increasing the chance of healthy behaviour change) and which users stop using their trackers after a short time.

Aims: The current study attempts to contribute to bridging this gap in our knowledge, by looking into factors predicting sustained use in the first year after purchase. Specifically, we look at the relative importance of a range of determinants from literature, i.e. demographic and socio- economical, psychological, health-related, goal-related, technological, user

experience-related and social predictors of feedback device use. Furthermore, this study tests the effect of these predictors on physical activity.

Methodology: 711 participants from four urban areas in France received a Fitbit ZIP activity tracker and gave permission to use their logged data. Participants filled out three questionnaires, at start, after 98 days, and after 232 days, to measure the above-mentioned determinants. Furthermore, for each participant, we collected activity data tracked by their Fitbit for 320 days.

Analysis: We determined the relative importance of all included predictors by using a machine learning analysis technique, Random Forest. This is an ensemble method that makes use of a large number of decision trees, strengthened by drawing random samples from the original data set with replacement. At each branch of the tree, a random selection of the predictor variables is considered, one of which is used to split the cases in an optimal manner. Random Forest analysis can produce a list of predictors, sorted by relative importance, and has the benefit of being able to deal with large numbers of predictor variables with complex interactions, especially in cases of relatively few participants.

Results: The data showed a slow exponential decay in Fitbit use, with 74% of participants still tracking after 100 days, and 16% of participants tracking after 320 days. On average, participants used the tracker for 129 days. Most important reasons to quit tracking were technical issues, such as empty batteries and broken or lost trackers (21.5% of all respondents). Random Forest analysis of predictors revealed that the most influential determinants were age, user experience-related factors, smartphone type, household type, perceived effect of the Fitbit, and goal-related factors. We explore the role of those predictors of which a difference in marginal means constitutes meaningful differences in days worn.

Discussion: This study offers an overview of the natural development of the use of an activity tracker, and the relative importance of a range of determinants from literature. Decay is exponential, but slower than may be expected from existing literature. Many factors have a small contribution to sustained use, but the most important determinants are technical condition, age, user experience, and goal-related factors. This finding suggests that activity tracking is potentially beneficial for a broad range of target groups, but more attention should be spent on technical and user experience-related aspects of activity trackers.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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22. Using Digital Support Groups to Promote Healthy Eating in Daily Life

Jennifer Inauen[1, 2]*, Niall Bolger[2], Patrick E. Shrout[3], Gertraud Stadler[4], Melanie Amrein[5], Pamela Rackow[4] and Urte Scholz[5]

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Rationale: Support groups are frequent components of weight-management interventions. However, they are expensive, and can face low attendance. Most importantly, this form of support is not available in daily life, when eating decisions are being made. We propose that digital interventions can overcome these limitations and effectively provide support at moments when it is most needed.

Aims: To provide a first experimental test of the hypothesis that receiving peer support in smartphone- based digital groups can enhance healthy eating in daily life. And to explore the temporal dynamics of behavior change during the intervention period.

Methodology: The research design comprised a randomized controlled trial with daily diary assessments. N=203 adults intending to eat healthily were randomized to an intervention condition (social support) or a control condition (information only), and one of two eating goals (increasing fruit and vegetable consumption vs. decreasing unhealthy snack consumption). After baseline assessments, all participants received information on their assigned eating goal, and then completed a 13-day diary. During Days 4 to 10, participants in the intervention condition were asked to support each other in achieving their eating goal in smartphone groups of 3-5 participants. Maintenance of intervention effects was assessed on Days 11 to 13, and one and two months post intervention. The primary outcome was daily servings of fruits and vegetables or unhealthy snacks consumed.

Analysis: The data were analyzed using multilevel modeling, which accounted for the fact that the 13 days were nested within individuals who were nested in different support groups (or the control group). The temporal dynamics of the intervention were investigated using a non-linear spline model.

Results: Participants in the social support condition showed a significant gradual increase in healthy eating over the intervention period, and ate on average 1.4 servings of fruits and vegetables more (CI95: 0.3, 2.6) or 0.8 unhealthy snacks less (CI95: -1.4, -0.2) than controls on Day 10, the last day of the intervention. Most of the effects were not maintained after the intervention ended.

Conclusions: Digital support groups can promote fruit and vegetable consumption and decrease unhealthy snack intake while they are ongoing. This study demonstrates the effectiveness of digital interventions to change health behavior in daily life. The results further provided interesting insights into the temporal dynamics of behavior change, and emphasized the importance of investigating such dynamics for building a theory of behavior change in daily life.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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23. Engagement with digital behaviour change interventions: Key challenges and potential solutions

Olga Perski[1]*, Felix Naughton[2], Alexandru Matei[3], Ann Blandford[4], Robert West[5] and Susan Michie[1]
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[2]School of Health Sciences, University of East Anglia, United Kingdom
[3]Digital Team, Nuffield Health, United Kingdom
[4]UCL Interaction Centre, University College London, United Kingdom
[5]Department of Epidemiology and Public Health, University College London, United Kingdom

Objectives: To (i) examine key challenges faced in obtaining engagement with digital behaviour change interventions and (ii) consider potential solutions.

Rationale: Engagement with digital behaviour change interventions (DBCIs) is typically very low. To improve engagement, we need to gain a better understanding of how to best characterise and measure it. This can lead to a better understanding of how to improve it. A review of the literature suggests that engagement needs to be considered in terms of behavioural, cognitive and emotional components, and that it arises from an interaction between characteristics of the user, the intervention and the context. However, we have yet to formulate a model of how to promote engagement in practice. Neither is it clear how far principles from human-computer interaction studies in other areas apply to DBCIs.

This panel discussion will consist of opening remarks from each of the panellists on what they see as the main challenges they have faced in their work and preliminary views on how these can be met in the future. This will pave the way for contributions

and questions from the audience. The session will conclude with final remarks from the panellists summing up what they see as the key messages from the session.

Speaker biographies:

Robert West is Director of UCL's Tobacco and Alcohol Research Group and is involved in designing and evaluating a range of different types of DBCIs in the field of smoking and alcohol use. He is author of A Guide to Development and Evaluation of Digital Behaviour Change Interventions in Healthcare.

Susan Michie is Director of UCL's Centre for Behaviour Change and is involved in research into DBCIs and in disseminating that research, including supporting a series of articles in the American Journal of Preventive Medicine, one of which is focusing on engagement challenges.

Olga Perski, UCL, is undertaking a PhD on how to conceptualise and measure engagement with DBCIs, with a particular focus on smoking cessation and alcohol reduction smartphone apps.

Felix Naughton is Senior Lecturer at the University of East Anglia. His research includes studies on how to tailor DBCIs and text-message prompts to promote engagement, and how to address the challenges of analysing data collected in real-time to enable DBCIs to be reactive to changes in users' circumstances.

Alexandru Matei is a computer scientist and digital developer based at Nuffield Health whose work is largely focused on harnessing machine-learning techniques to predict disengagement with commercial digital health services.

Ann Blandford is Director of UCL's Institute of Digital Health. Her research involves testing and extending theories that account for people's interactions with health technologies "in the wild". A key engagement challenge is to better understand the relationship between engagement with the DBCI and engagement with the target behaviour.

Conflict of Interest: Robert West undertakes research and consultancy and receives fees for speaking from companies that develop and manufacture smoking cessation medications. Alexandru Matei works for a commercial company that provides health and wellbeing services.

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Day 2: 23rd of February

24. Exploring smokers' and drinkers' choice of smartphone applications in an online store and their expectations of engagement: A think aloud study

Olga Perski[1]*, Ann Blandford[2], Harveen K. Ubhi[3], Robert West[3] and Susan Michie[1]
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[3]Department of Epidemiology and Public Health, University College London, United Kingdom

Rationale: Although public health organisations such as the National Health Service in the United Kingdom and the National Institutes of Health in the United States provide access to online libraries of publicly endorsed smartphone applications (apps), there is little evidence that users rely on this guidance when choosing apps. Rather, one of the most common methods of finding new apps is to search an online store. As there are currently more than 400 smoking cessation and 700 alcohol-related apps available on the market, smokers and drinkers must actively choose which app to download prior to engaging with it. The influences on this selection process are yet to be identified.

Aims: This study aimed to investigate 1) factors that shape users' choice of smoking cessation or alcohol reduction apps when searching an online store, and 2) factors rated as important for engagement.

Methodology: Daily smokers (n = 10) and excessive drinkers (n = 10) aged 18 or over, interested in using a smartphone app to quit or cut down, were recruited though social media and posters placed on central London university campuses. Consenting participants were asked to search an online store to identify and explore a free smoking cessation or alcohol reduction app of their choice whilst thinking aloud. Semi-structured interview techniques were used to allow participants to elaborate on their statements and to explore what factors were expected to be important for engagement.

Analysis: An interpretivist theoretical framework was used to inform the analysis, based on the premise that the "lived experience" of the individual can be captured through discussion between the researcher and participant. Verbal reports were audio recorded, transcribed verbatim and analysed using inductive thematic analysis.

Results: Participants chose apps based on their immediate look and feel, quality as judged by others' ratings and brand recognition, and titles judged to be realistic and relevant. Monitoring and feedback, goal setting, rewards and prompts were expected to be engaging because these were perceived to foster motivation and autonomy. Tailoring of content, a non-judgmental communication style, privacy and accuracy were viewed as important for engagement due to expectancies that these features would engender a sense of personal relevance and trust. Sharing progress with family and friends on social media and techniques to distract from momentary cravings were judged not to be engaging because of concerns about others' negative reactions.

Conclusions: Choice of a smoking cessation or alcohol reduction app may be influenced by its immediate look and feel, quality as judged by other users and titles that appear realistic. Features that enhance motivation, autonomy, personal relevance and credibility appear to be important for engagement.

Conflict of Interest: Robert West undertakes research and consultancy and receives fees for speaking from companies that develop and manufacture smoking cessation medications.

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25. Challenging the 'hierarchy of evidence' in digital interventions research: Using the Medical Research Council (MRC) framework to examine implementation, effectiveness, and mechanisms of action of Breaking Free Online

Sarah Elison[1]*, Jonathan Ward[1], Stephanie Dugdale[1] and Glyn Davies[1]

[1]   Breaking Free Online, United Kingdom

Rationale: Randomised controlled trials (RCTs) are considered 'gold-standard' approach when evaluating clinical interventions, however, such reductive approaches may not be the most appropriate for complex, digital behavioural interventions. Such interventions, formed of multiple components, can be tailorable to the needs of the individual and continually updated in response to evaluation work and as technological capabilities evolve. Therefore, published research evaluating computer-assisted therapy (CAT) programme for substance misuse, Breaking Free Online (BFO), is informed by guidance from the Medical Research Council (MRC). This MRC guidance recommends a perpetual cycle of development and evaluation, utilising multiple methodologies, to generate data spanning a 'hierarchy of evidence'. This guidance also highlights the importance of examining processes of implementation of interventions through existing healthcare systems, which is particularly relevant for digital interventions which may be perceived as 'disruptive'. In addition, the guidance recommends examining 'mechanisms of action' of individual intervention components, which is relevant when evaluating digital, tailorable interventions with content that may evolve over time.

Aims: To report findings from a mixed-methods research programme, informed by the MRC framework, examining implementation and clinical effectiveness of BFO, alongside mechanisms of action of tailoring advice within the programme and outcomes from specific intervention components.

Methodology: This research incorporates qualitative methods examining implementation of BFO with behavioural science theory used to conceptualise findings, and quantitative psychometric and clinical outcomes to evaluate effectiveness and mechanisms of action.

Analysis: Qualitative data were analysed via thematic analyses and quantitative data via analysis of variance and linear regressions.

Results: Studies demonstrate barriers and facilitators of implementation lying at multiple levels, including healthcare system and organisational levels, and at the level of the individual, providing targets for evidence-based implementation strategies. Global clinical effectiveness of BFO in addressing substance misuse and comorbid mental health issues is also demonstrated. Examination of mechanisms of action shows that tailoring advice provided by BFO to users, predicts which intervention components within the programme users complete, demonstrating that by assessing baseline profiles of need BFO can target the most appropriate clinical content for individual users. Completion of specific intervention components within BFO are demonstrated to be associated with specific clinical outcomes, with a dose response also being found. Mechanisms of action analyses have also revealed the primacy of cognitions, and the association between cognitive restructuring components in the programme and all biopsychosocial outcomes.

Conclusions: Published BFO research demonstrates the utility of the MRC framework in examining effectiveness and implementation of complex, digital, tailorable interventions. Informed by this research, the authors challenge the notion of a 'hierarchy' of evidence and propose a 'spectrum' of evidence may be more appropriate for complex, digital interventions such as BFO. Though RCTs are important in determining effectiveness of interventions, complex, digital behavioural interventions may require an evolved research paradigm, with the MRC framework providing a promising alternative within the bourgeoning field of digital behavioural change. Findings from this programme of research are being used to inform modifications to BFO, via an iterative approach, to continually update both the clinical content and technology platform.

Conflict of Interest: All authors are employed by Breaking Free Group where the Breaking Free Online programme has been developed

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26. Patient Flow: Design to Improve Patient Flow through Acute Medicine

Laís De Almeida[1]*, Ed Matthews[1] and Gianpaolo Fusari[1]

[1] Helen Hamlyn Centre for Design, United Kingdom

Rationale: Acute Medicine is the unplanned urgent care an adult patient receives when presenting to the hospital with a medical condition. When patients need to be admitted into hospital, they are likely to move into an Acute Medical Unit (AMU). These are highly resourced environments, staffed with multidisciplinary teams, to investigate and manage patients' conditions to determine the best care plan for them in a timely manner. AMUs have the potential of reducing the need for hospital beds if patients can be discharged directly home from this department. Nonetheless, AMUs are facing capacity and demand pressures. Could the design of communication tools that enhance the priority of discharges from AMUs result in a behaviour shift of hospital staff to the benefit of patient flow improvement?

Aim: 'Patient Flow' is a project to improve patient flow by reducing unnecessary delays through design. Initial research indicated that communication tools could use routinely collected data to visualise patient progress and overall ward status to relevant stakeholders, and enable timely discharges from AMUs, improving the experience of patients and staff.

Methodology: The project followed the Double-Diamond process(1), employing Inclusive Design methodologies. In the discover phase research included literature about Acute Medicine, interviews with clinical and non-clinical hospital staff, and over 150 hours of ward observations. During the define phase we synthesised the key challenges in AMUs, and prioritised areas of intervention against its impact and ease of implementation. During the develop phase we established design briefs for interventions through ideation workshops. Working closely to stakeholders we gradually distilled concepts into communication tools and conducted three phases of design testing to develop the visual language. Later in the deliver phase, the 'Patient Flow Board' went through iterative development, rapid prototyping, and coding development through a participatory approach that allowed for the co- design of solutions for real user needs and incremental improvement. 'Patient Flow Board' is being assessed for impact.

Results: Based on research and feedback from stakeholders we designed 'Patient Flow Board', that will improve information sharing amongst the multidisciplinary team for a more focused and timely discharge from AMUs. The software developed integrates with the hospital's current patient administration systems, and presents existing information in a more visual way. The main item of this visual language is the Care Journey Diagram that visualises the iterative investigation cycle until a differential diagnosis is achieved. This allows for stakeholders to acknowledge the patient's progress in the investigation cycle, it prompts the team regarding outstanding tasks, and allows them to plan ahead. The benefits of graphical tools have been broadly acknowledged by the multidisciplinary teams involved in their co-design and validation. They believe these can lead to more integrated care provision and directly improve patient flow. This tool is being prepared for a larger scale trial for impact measurement.

Conclusion: Evidence to date is that the communication tool under development will help hospital teams to prioritise discharge while improving patient flow through the system. Current evaluations will provide crucial evidence toward the adoption of the resulting tool.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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27. Removing barriers to behaviour change by employing user-centred research methods to design the physical interface between human and digital application.

Hawys Tomos[1, 2*], Jonathan West[1], Paul Rinne[2] and Michael Mace[2]

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[2]   Imperial College London, United Kingdom

GripAble is a computer games controller for hand-grip rehabilitation after a stroke. Gamification is successful in engaging and incentivising stroke patients to increase the amount of time they spend practising rehabilitation exercises (Rinne et al, 2016). These studies were conducted under test settings in which the patients were assisted by another person to set-up the intervention. In reality, independent practice needs to be achievable. This is fundamental in realising any behaviour change for patient benefit. User-centred design and design-for- manufacture methodologies were utilised to remove these barriers to change.

The three main challenges to practical use were:

- **Improving** usability for patients who have little or no use of one hand, so that the gripAble can be used independently in both hospital and home settings.
- Design for infection control, so that the intervention can be used in hospitals and be cleaned between patients.
- Making the controller manufacturable at scale and at low cost so that the intervention can be accessed by a greater number of people.

Early research in hospitals, anecdotal evidence from healthcare staff and literature studies led to the classification of three archetypal patients, briefly summarised below.

- Patient A: Lying. No control of arm and hand. Fingers have flicker movements only. Patient must use other hand to manipulate affected hand. Motivation non-existent due to perceived total inability.
- Patient B: Sitting. Gross movements returned to arm and hand but no intricacy in fingers. Weak hand needs some assistance from the other hand. Duration of recovery and frustration at prolonged inability negatively affect motivation.
- Patient C: Standing. Movement returned to arm, hands and fingers but affected side is still weaker than other side. Motivation lacking due to current level of recovery being sufficient to continue with daily tasks.

Through engagement with patients, families and healthcare professionals, designs were prototyped, evaluated, improved and iterated. Prototype forms were presented to individuals on a flat surface without explanation or indication of how to approach or use the objects. Interaction with the objects were observed and logged. Verbal feedback offered during the testing was recorded and further feedback collected. Forms were iterated to create a second round of prototypes for testing. This was repeated multiple times until a design could be selected as the best option for development. Design for manufacture methods were then applied to the design to increase production volume and reduce production cost.

The resulting design can be opened for cleaning, is more intuitive, easier and comfortable to use. It can be held in any orientation which allows a consistent and comparative log of the patient's progress for improved tracking and tailoring of therapy by healthcare professionals.

Positive user feedback has verified the need for inclusive design in overcoming barriers to use. This is vital in taking the behavioural change benefits of gamification out of the lab and into the real world.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.
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28. Improving quality of life and wellbeing amongst people affected by dementia: the impact of citizen science and digital interventions for informal care

Emilie Glazer[1]*

[1] Ctrl Group, United Kingdom

This talk will focus on Playlist for Life and Book of You, the two launch apps for Dementia Citizens, a citizen science platform that connects people affected by dementia with academic researchers. In addition to sharing the latest apps, the talk will describe the process through which they were developed, designed and researched.

In this talk we'll demonstrate how Playlist for Life and Book of You involve (a) an intervention to support dementia care and (b) an evaluation of the impact of that intervention on the person with dementia and their carer. Each app tests the hypothesis that wellbeing and quality of life will increase through app use, with future interest in applying this model of research to broader behaviour change measures. Currently, the Playlist for Life intervention enables people to create a playlist of personally meaningful music. In Book of You, the intervention invites people to upload photos and record stories to capture their memories. Both apps include wellbeing and quality of life questionnaires, and can be used by a person with dementia on their own, or together with a loved one.

Creating Dementia Citizens required working closely with people with dementia and their carers alongside an agile and iterative design and development process. This talk will outline how given the misconceptions and stigma that exist around people with dementia, along with the very specific needs that they experience everyday (and in particular in relation to technology use), it

was important for the apps to be tested with the dementia community early on and at each phase of work. Across discovery, alpha and beta testing, we created live prototypes on iPads and iPhones, and visited people with dementia and carers across the country. We spent time with them in their homes, invited them to use the apps and understood how they used the apps over time in their daily lives. Insights from those interviews directly shaped successive rounds of app design and development.

During this process two key considerations consistently arose, both of which will be explored. First, balancing the aim to create an engaging user experience with the requirements from the academic research partners to create a validated and robust study platform. Second, the need to deliver the study on a mobile device, where people can interact in their own time and in places that suit them - a contrast to the traditional setting that might include a lab or the presence of a researcher. Core elements of research, such as consent or questionnaires, were adapted in response.

As the talk will outline how the apps were designed, developed and researched, it will share the learnings, the latest app screens, and the potential directions for behaviour change research that citizen science platforms like Dementia Citizens could bring.

Conflict of Interest: The authors were commissioned by Nesta and the Department of Health to design, develop and research the Dementia Citizens launch apps.

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29. Applying a human-centered design process to increase acceptance of interactive health technology to support solid organ transplant patients' medication adherence, physical activity and weight control: the PICASSO-Tx project

Jasper Vanhoof[1], Bert Vandenberghe [2], Pieter Philippaerts[3], David Geerts[2], Patrick De Mazière[3], Sabina De Geest[1, 4] and Fabienne Dobbels[1, 4]*

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[4]University of Basel, Switzerland

Rationale and Aim: Although solid organ transplant (Tx) patients experience many difficulties in following their medication regimen and guidelines on physical activity and diet, the current evidence-base in self-management support interventions is scarce and methodologically weak. In other chronically ill patient populations, it seems that Interactive Health Technology (IHT) is a very promising pathway to deliver these behavioural support interventions. However, its success will depend largely on patients' preference and comfort with using these devices, highlighting the importance of actively involving patients in the development of the IHT. Therefore, the aim of the PICASSO-Tx project is to apply such a 'Human-centered design' process (HCD) in developing and testing an IHT to support Tx patients in their medication adherence and a healthy lifestyle.

Methodology: State-of-the-art HCD methodology was applied in four consecutive phases. First, a convenience sample of 122 Tx patients was interviewed to evaluate important technology acceptance factors and patients' current experience with technology, necessary to be able to select the IHT platform. Second, a contextual inquiry study was performed in a purposive sample of 20 Tx patients' homes to fully understand how patients currently manage their therapeutic regimen in daily life and how IHT might facilitate adequate self-management. Based on these steps, a multidisciplinary team started developing an IHT iteratively in a laboratory setting, asking patients to think aloud when observing paper sketches or performing tasks on prototypes. Finally, the prototype was tested in a field-usability study where the IHT was installed in 20 Tx patients' homes, who were consequently invited to use the technology in their daily lives for two weeks.

Results: Most patients found the development of IHT important and had a clear view on its preferred features. Since only 28% possessed a smartphone, a computer-based platform was preferred. Current self-management behaviours varied greatly

among patients, and many opportunities to tackle common barriers with IHT were identified. Three iterative laboratory testing rounds with 4 patients each were needed to evolve from paper sketches to a first IHT-prototype. Patients were highly satisfied and considered the prototype to be useful and easy to use after using it in their daily lives.

Conclusion: Our HCD process and smooth interdisciplinary teamwork resulted in the design of a useful and user-friendly IHT that seems to fit patients' self-management support needs. Next, it will be finalized by incorporating patients' concluding remarks, after which its efficacy and cost- effectiveness will be further tested.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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30. Digital self-monitoring of physical activity in people with type 2 diabetes - a randomized controlled trial

Thea Kooiman[1, 2]*, Martijn de Groot[1, 2], Klaas Hoogenberg[3], Wim Krijnen[1], Cees van der Schans[1, 4] and Adriaan Kooy[5, 6]

[1]Research group Healthy Ageing, Allied Health Care and Nursing, Hanze University of Applied Sciences, Netherlands
[2]Quantified Self Institute, Netherlands
[3]Martini Hospital, Netherlands
[4]University Medical Center Groningen, Netherlands
[5]Bethesda Diabetes Research Center, Netherlands

Rationale: Sufficient daily activity is of great importance for people with diabetes type 2. General guidelines indicate that engagement in at least 8000 steps/day is related to many beneficial outcomes such as a better physical fitness and quality of life. For people with overweight and diabetes type 2, increment of 2000 steps/day already relates to beneficial health outcomes such as lower blood glucose levels and weight loss. However, attempts to increase physical activity have not always been successful. E-health interventions, combined with self-monitoring techniques such as activity trackers, are lately recognized as potentially effective for optimizing physical activity behavior.

Aim: To determine the effect of a digital self-monitoring program on relevant variables of physical activity, glucotoxicity, and overweight/obesity in people with diabetes type 2.

Methodology: Adults with type 2 diabetes were randomized to either an intervention group or control group. Participants in the intervention group received access to a digital health program and an activity tracker. Participants randomized to the control group received usual care. Measurements took place at the start of the study (T0) and after 3 months (T1). Participants were included between April 29th 2015 and July 19th 2016.

Analysis: Independent samples t-tests and repeated measurements ANOVA were used to analyze the between-group differences on Hba1c, weight, and waist-hip ratio. Within group multilevel analysis was used to analyze the development of physical activity patterns over time; mean steps/day from week 0 (baseline) till week 12.

Results: A total of 72 adults (mean age 56 ± 11, mean Hba1c 70.4 ± 11.4, mean BMI 32.9 ± 5) with type 2 diabetes were included in this study. By time of writing, 62 participants had finished the intervention or control period, and physical activity data was available for 21 intervention participants. Participants in the intervention group walked on average 5002 steps/day (CI 3948; 6056) during baseline. During the intervention period, the mean number of steps varied from 5774 steps/d (CI 4752; 6795) till 6496 steps/d (CI 5481; 7508), and increased on average with 1062 steps/d. Pairwise comparisons revealed significant differences in week 3, 4, and 5 compared to baseline activity. The decrease in HbA1c between T0 and T1 was more prominent in the intervention group compared to the control group, however, not significant (mean difference 2.9, CI -2.2; 8.0, p=.25).

Changes in weight and hip-waist ratio were small in both groups (weight; mean difference 0.8 kg, CI -0.9; 2.5, p=.34, waist-hip ratio; mean difference 0.1 cm, CI -2.1; 1.96, p=.93).

Conclusion: Physical activity seems to increase during the intervention period, although the magnitude of this effect is not clear yet. The preliminary results indicate on average a clinically relevant decrement of HbA1c in favor of the intervention group, although this was not significant. No relevant results on weight reduction or hip-waist ratio have been found so far. After completion of data collection the results will be analyzed on different covariates and the feasibility of the program will be discussed. During the conference the final results will be presented.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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31. The needs and preferences of smokers regarding the use of personal carbon monoxide monitors linked to smartphone apps for harm reduction and cessation - an interview and think aloud study

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Rationale: Expired-air carbon monoxide (CO) measurement provides an objective way of assessing smoke intake and may provide a tool for smokers to reduce their smoke exposure or motivate them to stop completely. The advent of personal CO monitors linked to smartphone apps could allow smokers to use these devices more frequently and with little or no health professional involvement. However little is known about whether this would be acceptable or helpful for smokers.

Aims: This study aimed to explore smokers' views and preferences regarding use of personal CO monitoring devices and associated smartphone apps.

Methodology: The study involved two phases involving 12 smokers. First, a semi-structured interview explored participants' prior experiences as well as expectations and preferences regarding use of CO monitors and apps supporting cessation and CO assessment. Second, we conducted user testing and a think aloud study with existing apps that were developed to work with personal CO monitors developed by Bedfont Scientific Ltd. The interviews were audio- recorded and transcribed. The study was approved by UCL Research Ethics Committee.

Analysis: Data from both phases of the study were analysed in NVivo 10 and using Framework Analysis.

Results: From the two phases of the project, five key themes emerged: 1) prior experiences; 2) underlying needs; 3) views and expectations regarding CO monitoring devices; 4) views and expectations towards CO monitoring apps; 5) factors that could affect use of CO monitors and associated apps. Participants had high expectations towards use of personal CO monitors with a view to quitting, cutting down, and to gaining insights on smoking and on cessation efforts. Novelty and accessibility of CO testing and associated information emerged as key advantages. Priority features for apps included: simple CO testing journey, relevant and motivating feedback on results, and personalised collection of contextual data. Key expected barriers to use were features and usability of the CO monitor, and concerns over accuracy and relevance of results.

Conclusions: Personal CO monitors and associated apps may be an attractive tool for smokers to help them reduce their smoking, stop completely or better understand their tobacco use. However, there will be major challenges to make these devices and programs attractive and easy to use.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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32. Digital Cognitive Behavioural Therapy for insomnia in the real world: Does using a wearable device help?

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Rationale: Cognitive Behavioural Therapy is the recommended treatment for persons struggling with insomnia; insomnia is defined as trouble falling asleep, staying asleep or waking up too early for at least 3 nights per week for at least 3 months. Advanced digital technology (web and mobile) has the potential to scale up the dissemination of CBT, particularly since the field is struggling with a shortage of therapists. Digital CBT (dCBT) has been found to be effective for insomnia in randomised controlled trials but so far 'real-world' data are limited. In addition, little is known about the integration of wearable devices that estimate sleep into dCBT.

Aims: Assessing the effectiveness of dCBT in the real-world and the use of wearable devices within dCBT.

Methodology: A cohort of 3500 users (63% female, mean age 44.43 ± 14.78 years) who graduated from a dCBT program (Sleepio, Big Health Ltd, London, UK) and who completed an integrated post-therapy evaluation was selected for this study. This included 376 (10.7%) users who connected a wearable device to the program. The Sleep Condition Indicator (SCI, 7 Items), Patient Health Questionnaire (PHQ-2, 2 items), Generalized Anxiety Disorder (GAD-2, 2 item), and 1 item measures about perceived stress, life satisfaction and work productivity were collected at baseline and post-treatment within the program. In addition, we collected information about demographics, lifestyle and interaction with the program. All users consent to the anonymised use of their data when they access the program (www.sleepio.com/privacy). The abstract presents an evaluation of an ongoing service; therefore no approval of a research ethics committee was obtained.

Analysis: Group comparisons were made for those who connected a device to automatically generate daily diary data and those who did not connect a device, in addition to baseline to post- treatment comparisons. Data were analysed using Chi-square tests, t-tests (paired and unpaired), Mann-Whitney U-test (unpaired) and the Wilcoxon signed rank test depending on the measurement and distribution of the data.

Results: Sleep quality (SCI-7) significantly improved from 4.24 (SD:1.93) to 7.01 (SD:1.92) after dCBT for insomnia ($t(3453)=82.58$, $p<0.001$; Cohen's $d=1.44$), as did depressive symptoms (PHQ-2, $Z=-26.59$, $p<0.001$), anxiety (GAD-2, $Z=-29.41$, $p<0.001$), perceived stress ($Z=-28.37$, $p<0.001$), life satisfaction ($Z=-18.98$, $p<0.001$) and work productivity ($Z=-25.43$, $p<0.001$). Treatment effects were similar for those who connected a device and those who did not. Those who did connect a wearable device were interacting more with the program; users with a device connected were more likely to view the library (85.1% vs. 75.9%, Chi-square(1)=16.12, $p<0.001$), and although both groups were equally likely to view the community (80.1% vs. 80.2%, Chi- square(1)=0.01, $p=0.928$), the users who connected a device were more likely to post in the community (18.4% vs. 12.6%, Chi-square(1)=9.505, $p=0.002$).

Conclusions: dCBT is a suitable treatment for insomnia in the real-world and improves several well-being factors, next to sleep. Although wearable users are more likely to interact with additional components of the program, wearable devices did not affect treatment effectiveness. dCBT and wearables may therefore be useful to facilitate large scale treatment for insomnia.

Conflict of Interest: The position of AIL is funded by Big Health Ltd, the company behind the digital CBT program evaluated in this study. PFM is employed by Big Health Ltd. CAE is the clinical and scientific director of Big Health Ltd and holds shares in Big Health Ltd/Sleepio Ltd.

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33. CFHealthHub: The development of a digital intervention to provide feedback on objective nebuliser adherence data for adults with Cystic Fibrosis (CF)

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Rationale: Cystic Fibrosis (CF) is a life limiting condition affecting 10,000 patients in the UK. Preventative medication improves health outcomes however adherence is poor. PARI, have developed a nebuliser with data recording and transfer capability (eTrack), which works with the Qualcomm hub (a docking device) to enable wireless transfer of objective adherence data. We used this technology to develop a digital platform called CFHealthHub (CFHH) to display nebuliser adherence data and to provide suitable adherence support using behaviour change techniques for people with Cystic Fibrosis (PWCF).

Aim: The study aimed to test the eTrack/Qualcomm hub technology as a means of providing and feeding back objective adherence data, and to collect participant feedback to co-develop CFHH and an associated behaviour change intervention.

Methodology: This was a two-stage qualitative interviews study. Eligible participants were PWCF, aged 16 or older; willing to take treatments via the eTrack nebuliser. In stage one, five participants (3 female and 2 male, aged 20-33 years) used a beta version of the CFHH website, and were followed up after one week to troubleshoot any data upload issues. A semi-structured interview was conducted after one month. Stage two was conducted with 22 participants (14 females and eight males, aged 19-57 years) and involved rapid cycle development of the CFHH digital platform. Participants received four sessions with a physiotherapist over six months and were given independent access to CFHH. Semi-structured interviews with patients (n=18) and a semi-structured 'thinkaloud' protocol (n=6) were conducted by researchers during the intervention programme to elicit feedback on the acceptability and appropriateness of the CFHH content and interactions with the physiotherapist.

Analysis: In order to support the fast-paced development cycles, interviewers made notes during all interviews and wrote these up as soon as possible afterwards. For the think aloud protocol, the interviewer re-watched the video recording to identify parts of the video that showed technical issues or places where participants struggled to find content. All notes and video content were shared with the research team.

Results: The CFHH digital platform and intervention visits were found to be acceptable to patients. Issues identified related to the appearance of the website being too clinical, technical issues such as slow website speed, participants wanting to change the look of data display and tailor and personalise the appearance and content of the website, nebuliser issues such as problems with data transfer, infrequent use of the website, difficulties finding particular content, and additional wants such as a forum and smartphone app. Changes to the design and content such as enabling personalisation of the website, and developing push notifications, reminders and rewards were made based on this feedback.

Conclusion: We have developed a complex intervention to support medication adherence in PWCF, which includes data displays and a website, co-produced with patients. These components of the complex intervention are useable by, as well as acceptable and appropriate to PWCF.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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34. Physical Activity App Store Apps: How Can We Evaluate their Effectiveness?

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Rationale: Thousands of smartphone physical activity applications (apps) are readily available through app stores. However, the rapidly evolving nature of apps presents challenges for evaluating their effectiveness. Traditional methodologies, such as randomised control trials, are slow and often impractical. Alternative methodologies that can accommodate rapid evaluation of smartphone apps are required. App store platforms can be used to automate evaluation procedures, and potentially reach many users. Single Case Designs (SCDs) may be a compatible approach to evaluate the effectiveness of app store apps. However, SCDs involve rigorous methodological criteria, and the feasibility of implementing these in an app store environment has not yet been tested.

Aim: To explore whether SCD criteria can be implemented in an app store release of a smartphone app-based intervention (Quped), designed to promote physical activity through self-monitoring, goal setting and social comparison.

Methods: A mixed methods approach, including review and synthesis of SCD methodological criteria from established checklists to inform the design of the Quped app. Following deployment on the Apple App Store in February 2016, six months of smartphone-logged data was collected from users (aged≥18 years downloading Quped on an iPhone 5S or above), and 13 semi-structured interviews conducted.

Analysis: Descriptive analyses (frequencies and visualisations) of logged data and framework analysis of interview transcripts.

Results: Five methodological criteria were identified as essential to the application of SCDs in evaluating the effectiveness of app store apps: (i) repeated measurement of the outcome over time; (ii) at least three outcome measurements in both baseline and intervention phases; (iii) the intervention introduced at different time points to provide overlap between baseline and intervention phases across users; (iv) replication across users with different characteristics; and (v) users' perspectives on social acceptability (e.g. data privacy). These criteria were implemented during the deployment of Quped as follows: step counts (the outcome) were retrieved daily from internal smartphone sensors; retrieving steps retrospectively from the week prior to download provided baseline data; intervention timing was manipulated by delaying the introduction of goal-setting. 145 users downloaded Quped and consented to the study, and 80 (55.2%) were eligible for inclusion. 55/80 (68.8%) provided repeated measurement of steps during both baseline and intervention phases, but ≥3 data points per phase were only available for 43/80 (53.8%). Visualizations of download patterns revealed overlap between different users' baseline and intervention phases. 62 (77.5%) users provided information on their age and gender through the app's social comparison feature. Interviews suggested that participants were happy to provide their personal step count data to the research team, but were surprised that it could be accessed retrospectively.

Conclusion: The largely successful implementation of SCD methodological criteria in the design and deployment of Quped demonstrates that SCDs are a feasible approach for evaluating the effectiveness of app store PA apps. However, length of use and missing data may limit sample size considerably, and more work is needed to ensure users are fully informed of how (and when) their personal data will be collected.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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35. Time for Smart-Stroops? Alcohol-Stroop task smart-phone app shows superior psychometric properties.

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Background: In the current study we investigated the psychometric properties of two forms of alcohol Stroop task. A sample of beer drinkers completed a standard word-based Stroop and a picture-based Stroop consisted of beer pictures. We also contrasted their psychometric properties when delivered on a standard computer and as a smartphone application. Although alcohol Stroop task is widely used in the measurement of attentional bias, it has been found to have poor psychometric properties. Proposed solutions to improve these properties have been the inclusion of pictorial and personalized stimuli, as well as the increase of ecologic validity of the measurement through smart-phone applications.

Methods: 120 beer drinkers completed a general word and a personalized pictorial alcohol Stroop task; half of them on a standard computer in a laboratory and for the other half in a smart-phone app in their homes. An "alcohol involvement" outcome variable was also calculated adding standardized AUDIT and TLFB scores.

Results: Acceptable internal reliability was found for both pictorial ($\alpha = .74$) and word ($\alpha = .70$) Stroop's when conducted on a smart-phone, but not on the computer (words $\alpha = .49$; $\alpha = .58$ pictures). All participants showed a significant attentional bias towards alcohol related words, but there was no significant bias towards beer-related pictures. However no task performance was associated with alcohol involvement.

Conclusion: Ecological momentary assessment with a smart-phone app can improve the reliability of alcohol Stroop task, although poor construct validity remains an issue.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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36. Using time-series analysis to examine the effects of adding or removing components of digital behavioural interventions and associations between outcomes and patterns of usage

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Rationale: Time series analysis offers a novel method of gaining insight into the effects of specific digital intervention components on the causal mechanisms influencing outcomes and enables the assessment of the association between outcomes and measures of usage.

Aims: This presentation aims to introduce the notion of time-series analysis and give examples of how it can be applied to the analysis of digital behavioural interventions.

Content: The main components of time-series analysis (e.g. seasonality, underlying trends and autocorrelation) and methods of analysis (e.g. ARIMAX and multilevel modelling) will be discussed with reference to simulated data from a hypothetical digital behaviour change intervention. Two main time series designs will be considered: 1) interrupted time series design to assess

the effect of adding and removing components and 2) multiple time series design to assess the association between patterns of usage and outcomes of interest.

Conclusions: This presentation aims to provide an introduction to the benefits and uses of time series analysis when assessing digital behavioural interventions.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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37. The Virtual Care Climate Questionnaire: Development and validation of a questionnaire measuring perceived support for autonomy in a virtual care setting

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Rationale: Internet-based health behavior change interventions may be more effective if they offer autonomy-supportive communication facilitating the internalization of motivation for health behavior change. Yet, at this moment no validated tools exist to assess user-perceived autonomy-support of such interventions.

Aims: To develop and validate the Virtual Climate Care Questionnaire (VCCQ); a measure of perceived autonomy-support in a virtual care setting.

Methodology: Items were developed based on existing questionnaires and expert consultation, and pre-tested among experts and target populations. The VCCQ was administered in relation to Internet-based interventions aimed at reducing consumption of alcohol (Study 1; N=230) or cannabis (Study 2; N=228).

Analysis: Item properties, structural validity, and reliability were examined with item-response and classical test theory methods, and convergent and divergent validity via correlations with relevant concepts.

Results: In study 1, 20 of 23 items formed a one-dimensional scale (α=.97; ω=.97; H=.66; mean(SD)=4.9(1.0); range 1-7) that met the assumptions of monotonicity and invariant item ordering; in study 2, 16 items fitted these criteria (α=.92; H=.45; ω=.93; mean (SD)=4.2(1.1); range 1-7). Only 15 items remained in the questionnaire in both studies, thus we proceeded to the analyses of the questionnaire's reliability and construct validity with a 15-item version of the VCCQ. Convergent validity of the resulting 15-item VCCQ was confirmed by positive associations with autonomous motivation (study 1: r=.66, p<.001; study 2: r=.37, p <.001), and perceived competence for reducing alcohol intake (study 1: r=.52, p<.001). Divergent validity could only be confirmed by the non-significant association with perceived competence for learning (study 2: r=.05, p=.48).

Conclusions: The VCCQ accurately assessed participants' perceived autonomy-support offered by two Internet-based health behavior change interventions. Overall, the scale showed the expected properties and relationships with relevant concepts and the studies presented suggest this first version of the VCCQ to be reasonable valid and reliable. As a result, it may be used in future research and practice to measure perceived support for autonomy within a virtual care climate. Future research efforts may focus on further investigating the VCCQ's divergent validity, determine the VCCQ's validity and reliability when used in the context of Internet- based interventions aimed at improving non-addictive or other health behaviors, and develop and validate a VCCQ-short form.

38. Developing an understanding of user engagement with an online supported cognitive function test and its associated suggestions for protective cognitive health behaviours.

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Introduction: eHealth interventions are widely available and have varying effectiveness. One such intervention is the Cognitive Function Test (CFT) which is validated for 50-65 year olds and provides suggestions for protective cognitive health behaviours in later life.

Objective: To better understand what factors facilitate and hinder user engagement with the eHealth intervention and its suggested protective cognitive health behaviours.

Design: Four focus groups were conducted with participants who had indicated willingness to be involved in further research following a survey related to the CFT. The approach adopted was to discover how participants had approached the test, how they had found the test and how they had responded to it. A framework analysis approach was adopted to analyse the data using the COM-B model for behaviour change as its basis.

Findings: Fear of suffering dementia symptoms and the strain that might put on an individual or family emerged as a primary motivating factor for taking the test. The suggested lifestyle changes were seen as being achievable however, ingrained habits and behaviours were seen as being primary barriers to adopting the protective cognitive health behaviours. Also, the proliferation of news and media reports on the subject was shown to contribute to a sense of helplessness against the disease and also to exacerbate existing fears.

Conclusion: While some factors which affect an individual's likelihood of engaging with an eHealth intervention can be affected through the intervention itself, the more pervasive over- abundance of unfiltered information will continue to undermine an interventions verisimilitude unless addressed.

39. The role of e-service quality on customer satisfaction, loyalty and behaviour for a digital weight management program

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Rationale: Worldwide over half a billion adults are obese, with more than 1.9 billon overweight (Finucane et al., 2011). The effectiveness of current obesity treatment frameworks, many of which are grounded in weight management programs accessed via primary care, in achieving sustained reductions in body mass index (BMI) for the vast majority of obese, have been queried (Fildes et al. 2015). Increasingly, digital technologies are being adopted for the delivery of a broad range of health-related behaviour change programs (Free et al., 2013), including the prevention and treatment of overweight and obesity (Hutchesson et al. 2015). However, many weight management programs including digital programs have low rates of completion (Moroshko et al., 2011; Allen et al., 2014). Completion rates are related directly to outcomes (Bennett et al., 2014). Therefore, developing a comprehensive understanding of the factors which may contribute to higher rates of participant retention is critical for improving completion rates and health outcomes for more individuals (Koritzky et al., 2014; Goode et al., 2016). E-service quality can be an integral factor in determining customer completions in the e-service environment (Udo et al., 2010; Pearson et al., 2012; Bressolle et al., 2014) and therefore should be at the forefront of the design, implementation and evaluation of digital weight management programs.

Aim: To understand how consumer perceptions of e-service quality of an online weight management program influence satisfaction, loyalty (repeat use) and behavioural outcomes of participants.

Methodology: This study forms part of a larger research project. Data was collected via an online survey immediately following participation in a 12 week digital weight management program. The program includes a website and App where participants can access the nutrition, physical activity and mindset features of the program. Participants of the program self-selected into the study (N=407), 98% were female with a mean age of 42.9 years, 47.9% were normal weight, 22.9% overweight, and 7.6% obese (WHO, 2016). Study measures included behaviour, customer satisfaction and loyalty, service quality, service convenience, service support and website usability (scale sources available on request). Ethical clearance for the study was obtained through the researcher's university.

Analysis: Using SPSS software, data were first tested for validity and reliability. To test the proposed relationships data were analysed using multivariate general linear models.

Results: In this study (see Table 1 and 2) e-service quality, convenience, and service support were significant predictors of customer satisfaction, highlighting their importance in the design and evaluation of digital weight management programs. E-service quality, convenience and service support were also significant predictors of customer loyalty. Importantly, service convenience was found to be a significant predictor of both exercise and eating behaviour indicating that the convenience of the program assisted participants to increase their exercise and healthy eating behaviours.

Conclusions: To be effective and retain participants, online programs must be easy to use and convenient, providing participants with accessible, easy to follow instructions and permitting customisation to suit individual needs and preferences. The conclusion remains tentative owing to methodological limitations within the study's research design.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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40. How different are users and non-users of mobile health apps?

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Rationale: Mobile health apps are increasingly gaining popularity: over 105,000 health apps are currently available in the health and fitness category in the Apple Store, and over 65,000 in the medical category [1, 2]. While most studies have focused on the effects of mobile health apps on health outcomes [e.g., 3, 4], a significant antecedent question has been largely ignored: do systematic differences exist among people who use and people who not use mobile health apps? To better understand the

reach of mobile health apps and increase their effectiveness, it is essential to understand who are these mobile health app users and non-users.

Aims: This study aims to gain insight into differences between users and non-users of mobile health apps in demographic background, e-health literacy skills, and privacy concerns.

Methodology: A representative Dutch sample of 1,545 panel members were invited through a renowned research company to fill out an online survey. The survey started with questions regarding demographic background (i.e., gender, age, education level, income), e-health literacy skills (i.e., EHEALS [5]), and privacy concerns (i.e., MUIPC [6]). Next, mobile health app use was measured by asking participants to look at their smart device and report which health apps they had installed on their mobile device, and how often they used these health apps. A final sample of 1,079 adults provided eligible and complete data for analysis.

Analysis: Mobile health apps reported by the participants were coded to assess what kind of health apps are being used among Dutch citizens. Multinomial logistic regression analysis was conducted to predict aggregated mobile health app use. For the dependent variable, we distinguished between users (n = 315), non-users (n = 685), and those who only used preinstalled apps (n = 79). The non-users group was used as a reference category. All independent variables were entered into the model as continuous covariates, except for gender, which was included as dichotomous factor.

Results: Mobile health app users differed from non-users in terms of age, gender, income, e-health literacy skills, and privacy concerns, such that mobile health app users were generally younger (OR=0.96; 95% CI 0.95-0.97), male (OR=1.39; 95% CI 1.00-1.92), had a higher income (OR=1.00; 95% CI 1.00-1.00), had higher e-health literacy skills (OR=1.42; 95% CI 1.25-1.63), and were less concerned with their privacy (OR=0.68; 95% CI 0.54-0.85) than non-users. Those who only used preinstalled health apps were generally younger (OR=0.98; 95% CI 0.96-0.99), had higher e-health literacy skills (OR=1.38; 95% CI 1.11-1.73), and had less privacy concerns (OR=0.68; 95% CI 0.47-0.99) than non-users. Compared to mobile health app users, those who only used preinstalled health apps were on average older (OR=1.02; 95% CI 1.00-1.04).

Conclusions: Users of mobile health apps differ from non-users in terms of age, gender, e-health literacy skills, and privacy concerns. To increase the potential of mobile health apps, public health practitioners and policymakers should consider different intervention approaches to adapt mobile health strategies to different target groups and, eventually, to the individual user.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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41. Engaging fathers with a breastfeeding app: Preliminary process evaluation from the Milk Man mobile app intervention.

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Rationale: Breastfeeding is internationally recognized as the best first food for babies. Despite the recommendation from the World Health Organization that infants be exclusively breastfed for the first 6 months, many countries fall short of achieving this. Paternal support is integral to a woman's decision to initiate and continue breastfeeding yet fathers can sometimes feel unprepared for their new role. Previous research has demonstrated targeting breastfeeding interventions at fathers can be an effective approach. Mobile interventions offer unique opportunities to reach people with health information and to encourage

users to engage with the information, and with other users. There remain gaps in knowledge about how different engagement strategies can work best to reach different user groups, and engage them with health apps.

Aims: The Milk Man app intervention aims to increase the support that fathers provide their breastfeeding partners. The app uses a range of strategies designed to engage participants in information and conversations about breastfeeding and early parenting. It is anticipated that this increased support will result in an increase in the duration of exclusive and/or any breastfeeding.

Methodology: Milk Man is a mobile app designed specifically for fathers that is currently being trialed in the Parent Infant Feeding Initiative (PIFI) study. The PIFI is a four-armed, factorial randomized control trial (RCT) aiming to increase breastfeeding duration by targeting fathers with information and support. Expecting couples are recruited to the study from antenatal classes in Perth, Western Australia. Fathers randomly assigned to an app intervention group receive the Milk Man app from recruitment (antenatally) until their baby is 26 weeks old. The app aims to deliver time-relevant information to fathers about breastfeeding and early parenting through an information library and a conversation. Milk Man uses a number of engagement strategies designed to encourage fathers to use the app including targeted design, push notifications, social connectively and gamification. A customized analytics framework embedded in the app provides ongoing analytics data and process evaluation data is also collected from questionnaires administered to parents at 6 and 26 weeks post birth.

Analysis: Data collection for the RCT is ongoing. This paper will present preliminary process evaluation results from the first 204 Milk Man participants who have completed the study.

Results: Preliminary analysis of the 44,251 log events captured in the analytics framework reveal 690 conversation postings (average of 3.4 per user), 4006 library article opens (average of 19.6 per user) and 1756 poll votes (average of 8.6 per user). More in depth analysis of these data, combined with questionnaire data, will be presented at the conference.

Conclusions: The process evaluation results of the Milk Man app intervention will provide valuable insight into the acceptability of the engagement strategies, motivations for usage, patterns of app usage and user perspectives on the app. The results will be of interest to people developing health intervention apps, and in particular, those seeking to use innovative approaches to influence paternal attitudes about breastfeeding.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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42. The individual and combined impact of two social cognitive smartphone modules on application usage: a randomized factorial trial

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Rationale: The rapid evolution of mobile technologies has generated tremendous interest in their efficacy as tools for monitoring and impacting health behaviors. This rapidity, however, has challenged researchers' ability to provide effective scientific guidance to these health applications (apps). As a result, a majority of commercial apps are plagued by inefficacy and low sustained usage rates. Unsurprisingly, app usage is a primary driver of its efficacy. Accordingly, research is needed that establishes effective, theory-based intervention "ingredients" that promote ongoing usage and can be readily implemented by researchers and commercial developers.

Aims: We aimed to examine the individual and combined impact of basic physical activity app (BA; tracking, education, in-app and individually-tailored email/text-message feedback) plus two social-cognitive smartphone modules (interactive guided goal setting, points-based feedback) on application usage.

Methodology: We present a 12-week randomized factorial physical activity trial conducted within the preparation phase of the Multiphase Optimization Strategy (i.e., MOST) framework. Participants (N = 116) were randomized to receive the BA, the BA + points-based feedback, the BA + guided goal-setting, or the BA + points-based feedback + guided goal setting. Participants set distal physical activity goals based on public health recommendations for physical activity, and set highly specific weekly goals based on SMART goals principles and concepts from social cognitive theory. These weekly goals were used to craft the individual's physical activity regimen. Accordingly, those without the in-app goal module were provided printed materials. App usage was assessed via the number of times the application was accessed from the participant's smartphone home screen, and this was logged automatically.

Analysis: Hierarchical linear modeling was used to examine change in weekly application accesses over the course of the intervention. Fixed and random effects of linear and quadratic time, and the fixed effects for the goal-setting and points-based feedback modules were entered in a forward-stepping fashion. Predictors were retained in the model at the $P < .10$ level, and were considered significant at $P < .05$.

Results: The random linear effect for time was significant ($P < .01$), indicating that use decreased across conditions by 0.17 accesses per week from an initial level of 6.9 accesses per week. The fixed effect for goal-setting was significant ($P = .04$) whereby those with access to in- app goal-setting accessed the app approximately 1.91 additional times per week. Similarly, those with access to points-based feedback maintained an additional 1.88 accesses per week ($P = .04$).

Conclusions: Weekly usage remained fairly high across conditions at nearly one use per day, and the decrease in application usage across the trial was small but significant. Importantly, in-app guided goal setting and a points-based feedback system appeared effective for promoting higher usage. We believe these findings are of immediate utility to eHealth researchers and commercial developers, highlighting the utility of two theory-driven tools that can be readily implemented in future health applications.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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43. Uptake of, and engagement with, the SmokeFree Baby smartphone app to aid smoking cessation in pregnancy

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Rationale: Smartphone apps have been proposed to provide promising tools to reach those who do not engage with face-to-face behavioural smoking cessation support. However, little is known about the extent to which pregnant smokers download and engage with apps to aid cessation during pregnancy.

Aims: To assess the uptake of, and engagement with, a smoking cessation smartphone app for pregnant smokers ('SmokeFree Baby').

Methodology: Design: Data were collected in a full factorial screening experiment of the SmokeFree Baby app. The app was free and ad-free, and it was available worldwide from the Apple App store and Google Play. Recruitment largely depended on worldwide searches on the app stores. Active promotion of the app was only undertaken in England and it involved leaflets, online advertisements and a dedicated website. Participants were randomly allocated to one of 32 (2x2x2x2x2) experimental groups when they opened the app for the first time. Participants: Eligibility criteria included being pregnant, age 18 and over,

interested in stopping smoking and smoking cigarettes daily or at least once a week. Intervention: The app was designed around five experimental modules (identity change, stress management, health information, promoting use of face-to-face support, behavioural substitution), each in a 'minimal' and 'intensive' version. Measures: Data on participants' unique device IDs and app usage indicators were automatically registered in the study database. Participants completed a background questionnaire asking them about their sociodemographic and smoking characteristics.

Analysis: Descriptive statistics were calculated for participants' sociodemographic and smoking characteristics and engagement with the app.

Results: Between October 2014 and August 2016, 1,450 downloads were registered. Of these, 1,008 participants were randomised and 505 were eligible to participate. 93.3% of eligible participants (n=471) completed the registration and set a date to initiate behaviour change. 49% of participants (n=231) were from the UK, 63.3% (n=298) used an iOS device, and 70.9% were from low-socioeconomic groups (n=334). 29.3% of users opened the app only once (the day of registration) and 88.3% used the app five or fewer times.

Conclusions: A smoking cessation smartphone app may be attractive for pregnant women across the social spectrum to aid their quit attempt. However, the enrolment rate and participants' subsequent engagement with the SmokeFree Baby app were low.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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44. Estimating effectiveness of components of a smartphone app ('Drink Less') to reduce excessive alcohol consumption: a factorial randomised control trial

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Rationale: Smartphone apps could aid reduction in alcohol consumption and are widely available. To date no apps have proven effectiveness. It is important to test potential components of apps to assess which may be worth including in a version that can then be evaluated in an RCT.

Aims: To estimate the effectiveness of five components (normative feedback; cognitive bias re- training; self-monitoring; action planning, and identity change) of the 'Drink Less' app in helping people to reduce excessive alcohol consumption.

Methodology: A between-subject factorial RCT assessed the effectiveness of five intervention modules. Each intervention module had two versions ('intensive' and 'minimal') that yielded 32 experimental conditions to which participants were randomised. Excessive drinkers, aged 18+, who were from the UK and interested in reducing their drinking completed baseline measures on downloading the app and were contacted via email after one-month with a follow-up questionnaire. The primary outcome measure was change in past week alcohol consumption at follow up. Secondary outcome measures were change in AUDIT score, app usage data and usability ratings. Ethical approval was obtained from UCL Ethics Committee.

Analysis: A 5-way ANOVA assessed main effects and all 2-way interactions of the five intervention modules on outcome measures. An intention-to-treat approach was used with those lost to follow-up assumed to have continued drinking at baseline level. Sensitivity analyses were conducted with responders-only, and adjusting for usage data, drinking and socio-demographic characteristics.

Results: 672 participants were included and 27% responded to follow-up. At baseline, mean past week alcohol consumption was 39.9 units and AUDIT score was 19.1, indicating drinking at harmful levels, on average. By intent to treat there was an overall decline in alcohol consumption averaging 3.8 units per week and in AUDIT score of 0.74 points ($p < 0.001$ in both cases). There were numerically (but not significantly) larger decreases in alcohol consumption and AUDIT score for 'intensive' versions

of normative feedback, cognitive bias re-training and self- monitoring. There were significant two-way interactions between normative feedback and cognitive bias re-training on past week alcohol consumption (F=4.7, p=0.031) and between self-monitoring and action planning on AUDIT score (F=5.8, p=0.016). Overall, participants used the app an average of 11.7 times and for a mean of 4:23 mins each session. In general, participants rated the app significantly above average on ease of use (t=7.0, p<0.001) and satisfaction (t=2.7, p=0.008). Participants receiving the 'intensive' version of the self- monitoring module, compared with 'minimal', used the app significantly more times (F=12.7, p<0.001), and rated the app higher on 'helpfulness of the app' (F=4.4, p=0.038), 'likelihood to recommend the app to a friend' (F=5.0, p=0.027) and 'satisfaction with the app' (F=6.6, p=0.011).

Conclusions: The study suggests that a version of the Drink Less app that includes normative feedback, cognitive bias re-training, self-monitoring and action planning components may assist with drinking reduction, and merits evaluation in a full scale RCT with long-term outcomes.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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45. Evaluation of a web-based tailored nursing intervention to support optimal medication adherence among kidney transplant recipients: results from a mixed method study

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Rationale: Optimal adherence to immunosuppressive therapy is essential to ensure the long-term success of a graft. However, about 30% of kidney transplant recipients are not adherent to this treatment. In the domain of health behaviour change, digital technologies offer a promising way to deliver interventions to promote optimal medication adherence. A web-based tailored nursing intervention, Transplant-TAVIE, was developed. Based on the social learning theory and different techniques of behaviour change, such as tailoring, modeling, problem-solving and reinforcement, Transplant-TAVIE aims to empower kidney transplant patient to manage their immunosuppressive therapy optimally.

Aims: A mixed method study was conducted to evaluate the preliminary efficacy of Transplant-TAVIE and to document the experience of users.

Methodology: The study was conducted in a hospital setting in Montreal (Canada). To participate, kidney transplant recipients had to: be ≥ 18 years old; be taking immunosuppressant medication; and have access to the Internet. A convenience sample of 70 patients participated in the pilot randomized controlled trial (RCT). They were randomly assigned either to an experimental group (EG) (Transplant-TAVIE, n = 35) or to a control group (CG) (websites, n = 35) (1:1 allocation ratio). The primary outcome was medication adherence. The secondary outcomes were: self-efficacy, skills and medication side effects. All outcomes were measured with a self-administered questionnaire at baseline, and three and six months post-baseline. All participants (n=35) from the EG were invited to participate in the qualitative part of the study by sharing their experience of medication intake and of Transplant-TAVIE use. This study was approved by the Research Ethics Board of the Centre Hospitalier de l'Université de Montréal.

Analysis: ANOVA and General Linear Model were used to assess the differences between the RCT groups. Qualitative data were analyzed according to Miles and Huberman's methods. Three steps were performed: data reduction, data display, and conclusion drawing/verification.

Results: At baseline, participants in the pilot RCT were: 66% male, mean age of 52.7 years and received their graft 6.8 years ago. At baseline and over time, both group reported high adherence, high perception of medication self-efficacy and frequently used skills applied towards medication intake. Some experienced medication side effects and were slightly bothered by them. There was no difference between groups over time. Ten semi-structured interviews were conducted (80% male, duration: 10 to 30 minutes). The analyses of qualitative data provided five major themes: 1) kidney transplant is a gift of life; 2) medication intake is a daily habit; 3) participating in the virtual nursing intervention is a new and positive experience; 4) perceived benefits of consulting Transplant TAVIE and the virtual nurse; and 5) perceptions and exposure to Transplant-TAVIE is influenced by the "experience" of kidney graft and personal characteristics.

Conclusions: The experience of patients who used the Transplant-TAVIE showed that this new virtual nursing intervention was acceptable and helpful to better manage medication intake. Results seem to underscore the importance of offering the intervention to people with more problems with adherence or who are just beginning treatment. Transplant-TAVIE could constitute an accessible complementary service in support of existing specialized services.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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46. How do users engage with digitalised motivational interviewing features? User experiences with the app 'Precious'

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Rationale: The optimal methods for supporting intervention engagement have yet to be established, particularly within mobile interventions. 'Precious' app integrates motivational and volitional techniques from self-determination theory, motivational interviewing and control theory. Precious includes features that attempt to optimize user engagement with the intervention and increase physical activity.

Aims: This study aims to examine the acceptability and feasibility of Precious and to identify how digitalised features of motivational interviewing support autonomy and elicit change talk. Methodology: 12 adults took part in think-aloud walkthroughs and 24 inactive adults used the Precious app for six weeks, during which varied intervention techniques were offered. Walkthroughs and exit interviews with participants examined the feasibility of digitalised motivational interviewing, autonomy support, other usability aspects, and perceptions of how and why intervention techniques did/did not work for them.

Analysis: Inductive content analysis.

Results: Consistently with self-determination theory, users appreciated autonomy supportive features of Precious. Part of the users found the motivational interviewing elements useful, although the digitalised features did not always elicit optimal responses, e.g. change talk was only occasional. Among motivational and volitional techniques of the app, users most valued the gamified activity tracking features.

Conclusions: This study identified several factors that affect the engagement with a smartphone health app, specifically the usability of motivational interviewing elements, and identified a number of ways that such a service could be improved to optimally maintain user engagement.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

47. GPs' perspectives on prescribing for older people in primary care: a qualitative study

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Aims: Understanding the influences of General Practitioners' (GPs) prescribing behaviour is an important step in addressing medication-related problems and preventable drug-related morbidity in older adults in primary care. The aim of this study was to explore the determinants of GP prescribing behaviour for older adults in primary care and GPs' views on the potential role for specific interventions involving pharmacists and/or information technology systems (ITS) in general practice.

Methods: Semi-structured qualitative interviews were carried out with a purposive sample of GPs, until data saturation was reached. The interviews were audio-recorded, fully transcribed and saved in QSR Internationals NVivo Qualitative Data Analysis Software (V.10.22) to facilitate analysis. The method developed by Francis et al was used to determine data saturation (i.e. it was agreed that data saturation was reached once three consecutive interviews did not contribute further to thematic development). Three multidisciplinary researchers independently coded the interview data using a framework approach. Emerging themes were mapped to the Theoretical Domains Framework (TDF), a tool used to apply behaviour change theories. The consolidated criteria for reporting qualitative research (COREQ) statement was used to guide reporting of the findings. Ethical approval for this study was granted by the clinical research ethics committee of the Cork University Teaching Hospitals (reference ECM 3 (mmm) 14/04/15 & 4 (k) 07/10/14). All participants provided written informed consent.

Results: Sixteen GPs participated in the study. The interviews ranged from 9 min to 31 min (mean interview length 19 min).The mean duration of participating GPs' medical experience was 17 years. The number of GPs working in a practice ranged from 1 to 6. Seven of the fourteen domains in the TDF were identified as being important determinants of GP prescribing behaviour: "Knowledge", "Skills" "Reinforcement", "Memory Attention and Decision Process", "Environmental Context and Resources", "Social influences", "Social/Professional Role and Identity". Participants reported that the challenges associated with prescribing for an increasingly older population will require them to become more knowledgeable in pharmacology and drug interactions and they called for extra training in these topics. They viewed strategies such as academic detailing (AD) sessions delivered by pharmacists or ITS as having a positive role to play in optimising prescribing.

Conclusion: This study highlights the complexity of prescribing behaviour for older people in primary care and the need for additional supports to optimize prescribing for this growing cohort of patients. Interventions that incorporate, but are not limited to interprofessional collaboration with pharmacists and ITS were identified by GPs as being potentially useful for prescribing behaviour, therefore require further exploration with a view to improving patient outcomes.

Conflict of Interest: The authors declare no competing interests in preparing this article.

48. Cancer survivors' experiences of using publicly available physical activity mobile apps: a qualitative analysis

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Rationale: Regular physical activity (PA) improves cancer survival and reduces risk of breast, prostate and colorectal cancer recurrence. PA can also reduce fatigue, pain and sleep problems. Effective interventions to promote PA in cancer survivors are needed and mobile interventions have shown potential. There are many PA mobile apps available for public use but none specifically developed for cancer survivors have been identified.

Aims: We aimed to assess breast, prostate and colorectal cancer survivors' opinions and experiences of using PA apps designed for public use.

Methodology: We identified four PA apps (Human, The Walk, Johnson & Johnson's 7 Minute Workout, Gorilla Workout) publicly available to download on iOS and Android devices. Each participant was randomly assigned to two of the apps during an initial telephone interview where details of diagnosis and treatment, current PA and use of PA digital technologies were collected. Participants used both apps during a 2 week period, focusing on one app during each week. A recorded semi-structured telephone interview was conducted to understand participants' experiences of downloading and using each app, the content, features and relevance to them as a cancer survivor, and how PA apps should be developed or adapted in the context of cancer.

Analysis: Qualitative thematic analysis was used to identify themes related to the participants' feedback and experiences of using each app and PA following cancer diagnosis and treatment.

Results: Analysis is ongoing: preliminary results suggest that the use of apps to deliver a PA intervention was supported and that these generic PA apps are satisfactory for people who have completed cancer treatment. Recommendations were made to suggest that information about the importance of PA after cancer (i.e. improved survival, reduced recurrence) should be incorporated into a cancer-specific PA app. This should also address common concerns regarding PA participation after cancer (e.g. fatigue, reliable guidance and support for safe and appropriate PA after treatment and surgery). Those participants who had recently finished treatment tended to report the highest need for a cancer-specific PA intervention, that should be delivered soon after treatment, when side effects are most apparent and support is most required. For those who were several years post-treatment, many felt that these generic PA apps were largely suitable as most of the side effects had subsided and they wanted to move away from 'cancer-specific' support. Apps which suggested specific strength/resistance-based exercise programmes were preferred by those with higher levels of motivation to improve PA and fitness, whereas those with low levels of motivation generally found that the four apps offered little in terms of increasing motivation or PA participation. Full results will be available by the time of the CBC Digital Health Conference in February.

Conclusions: Preliminary conclusions point towards the need for cancer-specific, tailored physical activity apps, targeted towards survivors who have recently finished treatment, with a greater focus on increasing motivation among those where this is low.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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49. Real-time paediatric respiratory tract infection (RTI) community surveillance: A qualitative interview study of clinicians' perspectives on the use, design and potential impact of a planned intervention.

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Rationale: Over-prescription of antibiotics in primary care is a contributor to burgeoning problem of antimicrobial resistance. Children with respiratory tract infections (RTI) represent a substantial proportion of primary care consultations and antibiotic prescribing. An online intervention presenting locally-relevant real-time paediatric RTI (syndromic and virology) surveillance data is planned with an intention of improving the care of children with RTIs – potentially by reducing diagnostic uncertainty and enhancing patient explanation - which could help reduce unnecessary antibiotic prescribing.

Aims: The aim of this study is to inform the development of the proposed intervention by exploring clinicians' perspectives on:

- the use, value and potential impact in practice of a surveillance intervention
- barriers and facilitator to intervention use, including preferences for intervention content, design and delivery

Methods: Semi-structured one-to-one interviews were conducted with 21 clinicians (18 GPs; 3 Nurse Practitioners) representing a range of clinical experience from a range of Bristol GP surgeries (deprivation deciles 1 to 9). Interviews explored clinicians' current approaches to managing paediatric RTIs, knowledge of circulating infections, and views of a mock-up example of viral and syndromic surveillance information - including information on normal symptom duration.

Analysis: Interviews were audio recorded, transcribed verbatim and analysed using the framework method.

Results: Clinicians agreed there is currently no formal primary care system for identifying circulating infections, and the surveillance information was novel and potentially useful. There were mixed responses to the potential use and impact of the intervention, both across and within interviews. While some support was evident for the intended effects of the intervention (reducing diagnostic uncertainty and subsequently antibiotic prescribing), many clinicians queried the relevance of knowing community viral microbiology, reporting their role as to identify the truly sick (requiring treatment) amidst general 'viruses going around', and to treat each child individually (independently of group data). Clinicians expressed a preference for risk-related information or changes to look out for, rather than general epidemiological information. The clinical backdrop of fear of missing the sick child was a prominent theme. Perceived intervention benefits included enhancing patient explanations/expectation management more than decision-making, and symptom duration was perceived as particularly useful in this context. Barriers identified included time pressures, information overload and lack of fit with perceived role of clinician. Design and delivery preferences were for the information to be easily accessible.

Conclusions: Complex, mixed responses were elicited from clinicians to the provision of online paediatric respiratory infection microbiological and symptomatic surveillance information in terms of perceived use, utility and impact in practice. Whilst clinicians viewed the information as beneficial for supporting consultations with parents, they questioned how knowledge of viral microbiology could or should inform their practice of treating each patient individually. Intervention development will ensure it takes account of time pressures and information overload and clinicians' preferences for risk information.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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50. Design and development of a web app for contraception decision-making

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Rationale: Women have many concerns about contraception which can mean that they are put off choosing and using reliable methods. Long-acting contraceptive (LARC) methods are much more effective than other options (such as a daily pill), but fears or misunderstandings about contraception may deter women from seeking LARC. Women may be worried about known side effects, but many other concerns are myths or misunderstandings. Such concerns may not surface in consultations with health professionals, especially if services are over-stretched. Increasingly women turn to the Internet including social media for information on health, and to discuss issues with others. We describe the design and development of the 'BeCCY' (Best Contraception Choice for You) web app which addresses powerful myths and misconceptions about contraception, and provides tailored recommendations for contraceptive methods which fit with women's preferences.

Aim: to describe the rationale and evidence base for the design of the Best Contraception Choice for You (BeCCY) web app

Methodology: We synthesised evidence from several sources to inform the design of the BeCCY web app. We conducted three systematic literature reviews:

- A qualitative synthesis of systematic reviews of factors influencing contraceptive choice (women's views and explanatory theoretical frameworks)
- A meta-analysis of randomised controlled trials of interactive digital interventions for contraceptive decision-making
- A narrative synthesis of trials of non-digital interventions for contraceptive decision-making. We also analysed views on contraception expressed on YouTube (35 videos), and conducted focus groups with women aged 15 to 30, recruited in clinic and pharmacy settings (ongoing).

Analysis: YouTube videos and focus group data were analysed thematically. Themes from the qualitative field work and findings from the reviews of evidence were tabulated, and we discussed each finding to consider the implications for the design of the BeCCY web app. Design ideas were presented to focus groups of young women, and wireframes and design proposals adapted in the light of their views and suggestions.

Results: The most common myths and misconceptions about contraception include worries about hormones being unnatural, weight gain, altered bleeding patterns, cancer and future infertility. The BeCCY web app addresses myths and misunderstandings through videos (of health professionals and of peers), method-specific information (including 'did you know?'), and an interactive tool which gives tailored suggestions for contraceptive methods ('What's right for me?').

Conclusions: The BeCCY web app will be offered to young women on tablet computers in clinic waiting rooms (and via mobile phone), and will be tested in a pilot randomised controlled trial starting early in 2017.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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51. An e-health behavior change system for habit formation: Application of the person-based approach to develop the online program 'Make one small change'

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Background: Recent research has associated increased employee well-being levels with higher levels of productivity and lower levels of absenteeism and presenteeism. This has influenced large organisations including the National Health Service (NHS), to invest in well-being programs for staff and digital advancements have allowed for online employee health risk assessments (HRA) and subsequent e-health interventions to be implemented with ease. Effectiveness of well-being programs has produced conflicting results though and one reason for this may be engagement. The recently developed "person-based" approach may offer the means for developing an e-health intervention that is accessible and population relevant. Make One Small Change (MSC) is an intervention that has been designed using this approach so as to specifically engage a global work age population to change their health behaviours one step at a time. It is a multi-lingual e-health program addressing habit formation in the areas of resilience, movement, eating and sleep.

Aim: To develop an acceptable online well-being intervention for employees within large organisations using the person-based approach so as to increase engagement.

Methods/Results: In Phase 1 the acceptability of the intervention was tested with eight participants using mixed methods so as to facilitate early identification of beneficial of the intervention as well as initial barriers specifically according those belonging to the population of the intended users. There is a strong emphasis on qualitative research when using the person-based approach and data was collected by individual interview. In Phase 2, guiding principles, a key element of the person-based approach, were produced. Insights gained from participants at this stage are used to form these principles which then address context-specific issues of the intervention. With MSC, participants reported the need for bited-sized actions, highly tailored to their personal lifestyle and their general goals in the domain being considered. Usability, visual appeal and low levels of content (and reading) were the key design principles. Feedback was used to design the intervention around the principle of the user who chooses from a "curated list" of SMART actions which could be implemented within one week. Additional support during the week is drawn from behaviour change strategies which answer specific needs of users in these interviews. In Phase 3, findings for interviews informed the design of the program. Individual interviews were held with a further 32 participants in eight rounds of refinement and testing screens, images, text size and approaches to content writing for motivation and encouragement.

Conclusions: The MSC intervention is now in the final stages of development and is due to be launched early 2017. Intervention assessment and evaluation will be on a weekly basis using standardized questionnaires and compared to a baseline health risk assessment previously validated. It is hoped that the application of the person-based approach throughout development will enable MSC to be engaging enough to produce measureable behaviour change.

Conflict of Interest: All authors are either directly employed or contracted by Cigna who will be commercializing the final product derived from this research.

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52. Application of the Behaviour Change Wheel to the development of digital interventions for older adults: A case study using City4Age

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Rationale: The Behaviour Change Wheel (BCW) has been used successfully as a starting point for designing interventions. However, it may also be possible to apply this framework at a later stage in the design process. Especially in industry-led or interdisciplinary projects, the expertise of behavioural scientists is sometimes only requested after an intervention has been designed but before it is implemented. Therefore, there is a need for developing and assessing a method for applying the BCW framework to improve already designed interventions.

Aim: To develop and assess a method for how the Behaviour Change Wheel (BCW) framework can be applied to improve already planned interventions using a case study of digital health interventions for older adults planned within an EU funded project (City4Age).

Method: The City4Age project proposed a total of 30 interventions across six test sites. For each of these interventions, we collated information on the target behaviour, intervention function, and mode of delivery. In addition, we conducted literature reviews to identify known facilitators and barriers of each of the target behaviours. Next, each intervention was coded onto the BCW, and the barrier or facilitator it addressed was coded onto the COM-B component of the framework by two coders. Finally, we compared the proposed intervention functions with those most likely to be effective for each target behaviour. For those unlikely to be effective, we suggested alternative interventions to the test site.

Results: Our method for applying the BCW framework to designed interventions identified that the majority of the interventions did not plan to use appropriate intervention functions. Moreover, applying the BCW framework in this manner allowed us to identify what interventions needed refining. It also guided us in providing specific guidance in our recommendations for improvements.

Conclusion: In a large interdisciplinary collaboration developing digital interventions for older adults, it is possible to apply the Behaviour Change Wheel framework to planned interventions in order to provide focused and actionable feedback for improvement prior to deployment.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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53. Systematic development of an online intervention to support infant feeding (iFeed)

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Rationale: Mothers report stopping breastfeeding earlier than intended due to difficulties that could be prevented or resolved with skilled support. Parents report looking online for information and/or social support regarding infant feeding, but find it difficult to determine what is reliable, usable and evidence-based. For those who do not wish, or are unable to breastfeed the usual alternative is to offer formula milk by bottle. Parents report difficulties accessing timely and appropriate guidance about bottle feeding which may contribute to unsafe practices. Furthermore, parents choosing to formula feed may miss messages that encourage a responsive style of feeding and promote parent-infant bonding.

Aims: The aim of this research was to develop an inclusive, online intervention to encourage skin-to- skin contact and responsive feeding, encourage and support confident breastfeeding, and enable safe bottle feeding when required.

Methodology: The needs analysis comprised of a systematic review of digital interventions for infant feeding, content analysis of existing digital interventions (apps and websites), and a review of national guidelines for infant feeding support in order to list the required topic areas for a comprehensive intervention. Institutional ethical approval was confirmed before the project start. The target areas of breastfeeding and safe bottle feeding were broken down into specific behaviours and performance

objectives for both mothers and their partners. For the specified behaviours the Behaviour-Change Wheel approach was applied (Michie et al. 2014). Barriers and facilitators were identified from the qualitative literature and from consultation with parents (n=22), and these were categorised using the COM-B model (e.g. reflective motivation, physical opportunity etc), before identifying theoretical domains and intervention functions. We considered all relevant BCTs for each category in terms of their relevance for addressing the barriers and facilitators and the feasibility of delivering them via an online platform. A team of experts in behaviour change, infant feeding, and midwifery discussed the selected BCTs and developed suggestions of how to implement these in the intervention. Health professionals and parents were encouraged to comment on these ideas or offer alternatives via an online forum.

Results: The final intervention will comprise of information tailored to expectant parents, parents of infants under 1 year, and those who want to support others (i.e. grandparents/ partners). For expectant parents the content will focus on increasing both reflective and automatic motivation for breastfeeding, increasing perceptions of capability and suggest ways for parents to increase the physical and social opportunities for breastfeeding. For those who do not wish to breastfeed the content focuses on increasing skin to skin contact and responsive (baby-led) bottle feeding style. For those with infants under 1 year the intervention will link to previously developed intervention for supporting sustained breastfeeding (B Skills app) and will give information about safe and responsive bottle feeding.

Conclusions: There is a need for a comprehensive online intervention to support both breastfeeding and safe and responsive bottle feeding. The intervention software is currently in development and will be tested with parents and health professionals for acceptability before evaluation in a future trial.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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54. Real-world perspectives on the implementation and sustainability of digital behavioural interventions: Context specific and general barriers and facilitators

Sarah Elison[1*], Stephanie Dugdale[1], Abdul Ghafoor[2] and Mark Weston[3]
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[3]Change, Grow, Live (CGL), United Kingdom

Objectives: This panel discussion draws on the research and commercial experience of the contributors to explore barriers and facilitators at multiple levels, of the implementation and sustainability of digital behavioural interventions.

Rationale: Sarah Elison directs the Breaking Free Group research programme which is informed by the Medical Research Council Framework (MRC) for the development of complex interventions, and places implementation as a central part of this process. This is because many promising interventions fail to translate from research to standard practice, which may be particularly relevant to 'disruptive' digital behavioural interventions. Sarah's research explores implementation processes using behavioural science theory to conceptualise findings, to inform approaches to overcome barriers to implementation and sustainability of her organisation, such as co-production of implementation approaches thorough partnership working with commissioning services.

Stephanie Dugdale conducts research at Breaking Free Group examining processes of implementation and normalisation of digital behavioural change interventions. She has found that research, particularly qualitative research using behavioural science theory to conceptualise findings, may be particularly informative in uncovering barriers to implementation. Stephanie has also conducted research into different approaches to implementation of such interventions, and has helped her organisation to devise ways to optimally implement their own digital health interventions, including delivery via peer supporters.

Abdul Ghafoor works at Public Health England (PHE) leading on the implementation of digital health products, and has international experience of delivering large-scale digital change programmes in consumer and B2B markets. He has found that some barriers to implementation may be more general, and relate to societal attitudes to the progressing paradigm shift into the digital era and the disruption this may cause. In his role at PHE he has gained insight into the importance of tailoring implementation approaches to the specific target clinical population and their level of need. Abdul has also found that barriers to implementation are often context specific, and relate to a particular country's health care system, and political and cultural factors.

Mark Weston is New Technologies Trainer at social care and health charity, Change, Grow, Live (CGL), one of the UKS largest substance misuse treatment providers. At CGL, Mark is responsible for the national roll-out of new technologies throughout the organisation, including digital approaches to recovery such as Breaking Free Online. His role at CGL involves training staff across the organisation to use these new technologies, and also consultancy to inform organisation-wide approaches to successful implementation. Before his current role at CGL, Mark has worked in other roles in the substance misuse sector, and has also worked in the digital technology sector at Fujitsu Consulting, as a Service designer and Business Processes Consultant.

Summary: Via their combined experience of conducting research into implementation of digital health interventions, and devising approaches to make digital health interventions commercially sustainable, valuable lessons have been learnt by the panel, which may be of interest to the wider digital health community. This panel session will provide an opportunity to report on those lessons, in the hope that they will provide guidance to other digital intervention developers to contribute to the continued evolution of a sustainable digital health sector.

Conflict of Interest: Dr Elison and Mrs Dugdale are employees of Breaking Free Group.

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Poster Presentations

1. Use of digital and non-digital aids for smoking cessation and alcohol reduction: a population survey of adults in England

Emma Beard[1]*, Jamie Brown[1], Susan Michie[1], Eileen Kaner[2], Petra Meier[3] and Robert West[1]

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Rationale: It is important for policy and planning to chart the methods smokers and high-risk drinkers use to help them change their behaviour.

Aims: This study assessed prevalence of use, and characteristics of users, of digital and non- digital support for smoking cessation and alcohol reduction in England.

Methodology: Data were used from the Smoking and Alcohol Toolkit Studies, which involve monthly face-to-face computer-assisted interviews of adults aged 16+ in England. We included the data collected between June 2014 and July 2015 on the 1600 smokers who have made at least one quit attempt and 911 high-risk drinkers (defined as scores >8+ on the full AUDIT or 5+ on questions 1-3 of the AUDIT-C) who have made an attempt to cut down in the past 12 months. Participants provided information on their socio-demographic characteristics and use of aids during their most recent quit attempt including pharmacotherapy, face-to-face counselling, telephone support, printed and digital self-help materials, and complementary medicine.

Results: A total of 60.3% of smokers used aids in the past year, compared with just 14.9% of high-risk drinkers. Use of pharmacotherapy was high among smokers and very low among drinkers (56.0%versus1.2%). Use of other aids was low for both behaviours: face-to-face counselling (2.6%versus4.8%), digital self-help materials (1.4%versus2.6%), printed self-help materials (0.0%versus1.5%) and complementary medicine (1.0%versus0.5%). Use of aids was more common among smokers aged 25-54 compared with 16-24 year olds (25- 34,ORadj1.49,p=0.012; 35-44,ORadj1.93,p<0.001; 35-44,ORadj1.93,p<0.001; 45- 54,ORadj1.66,p=0.008), with cigarette consumption >10 relative to <1 (10- 20,ORadj2.47,p=0.011; >20, ORadj4.23, p=0.001), and less common among ethnic minorities (ORadj0.69, p=0.026). For alcohol reduction, use of aids was higher among ethnic minority groups (ORadj2.41;p=0.015), and those of social-grade D/E relative to AB (ORadj2.29, p=0.012&ORadj3.13, p<0.001).

Conclusions: In England, the use of pharmacotherapy is prevalent for smoking cessation but not alcohol reduction. Other aids are used at a low rate, with digital self-help being more common for alcohol reduction than smoking cessation.

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2. The role of trust in eHealth websites: the enduring power of impartiality

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Background: Within a year period, 72% of internet users seek health information online (Pew Research, 2014). The internet has provided a valuable alternative to physical contact with health practitioners by increasing the availability and access of information. However, with this increased access come concerns about the quality of the information source that consumers choose to trust and act upon. Understanding what causes users to trust health websites is important to understand how it leads to behavioural changed. We have studied eHealth trust during early internet adoption (Briggs et al. 2000) and from the introduction of web 2.0 (Harris et al., 2011), however more attention on the role of advice from patient experiences (PEx) (Sillence et al., 2013) and privacy concerns (Kim, 2014) on health website trust formation is needed.

Objective: The current study aimed to (1) update our existing trust questionnaire to incorporate greater consideration of PEx and the role of privacy concerns, (2) assess the factorial structure of the trust questionnaire and (2) model how these factors predicted trust, information corroboration, users' threat perception, coping assessment and readiness to act on the advice contained within health-related websites.

Methods: Participants were asked to recall a site they had used previously to search for health information. They were then asked to complete the trust questionnaire in relation to the website and answered a number of questions assessing their threat and coping appraisal, information corroboration and checking. 1123 participants were recruited from an online panel with 56% from the USA and 44% of the UK. An online panel was chosen to recruit a demographic similar to that recruited in our existing studies as our previous recruitment platform no longer existed. The factorial structure of the eHealth web trust scale was assessed using Exploratory Factor Analysis (EFA) and then modelled how those factors predicted the outcome measures using Structural Equation Modelling (SEM).

Results: EFA revealed four factors: PEx, credibility and impartiality, privacy and familiarity. In the SEM, of these four factors, only credibility and impartiality had a direct effect on trust. The role of PEx had an indirect effect through information corroboration suggesting that whilst users may not trust PEx content, corroborating such information through other sources heightens users trust. Privacy and familiarity only had indirect effects on trust. The final model accounted for the trust markers, trust in health information, information corroboration, coping and intention to act. This model achieved a good fit (GFI (.95), AGFI (.93), RMSEA (.50) and CFI (.97)) and accounted for 65% of the variance in trust, 27% of the variance in coping and 41% of the variance in intention to act.

Conclusion: In line with our existing studies (Harris et al., 2011; Sillence et al., 2013), impartiality is the only trust marker to remain a stable predictor of trust. Previous PEx work (Sillence et al., 2013) has found the content to negatively influence trust but our findings suggest it can have a positive influence on trust provided that users corroborate the information through additional sources.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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3. A web-based nursing tailored intervention to support health behaviour change among people living with HIV: development and demonstration of TAVIE en santé

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Background: The life expectancy of HIV-infected individuals with access to antiretroviral therapy (ART) is now measured in decades; among those optimally treated, it can approach that of uninfected populations. However, the long-term use of ART, the normal aging process, and the presence of certain lifestyle risk factors have been associated with risks for diabetes and cardiovascular disease. Case management of people living with HIV (PLHIV) must now include risk-reducing interventions aimed at supporting their efforts to adopt positive health behaviours. A web-based tailored intervention, TAVIE en santé, was developed to support health behaviour change among PLHIV. The groundwork for the intervention was provided by the earlier creation of a virtual nursing intervention concept called TAVIE, the French acronym for Treatment Virtual Nurse Assistance and Teaching, and its innovative Web platform.

Goal: This presentation will describe the development and demonstrate the TAVIE en santé intervention.

Development:
Clinical content development:
TAVIE en santé was developed through an Intervention Mapping (IM) framework based on a six-step process.
Step 1: A needs assessment was conducted to identify risk factors leading to health problems among PLHIV and determinants of behaviour. This led to a focus on 3 key behaviours (smoking cessation, physical activity, healthy eating) and 3 key determinants of behaviour (intention, attitude and perceived behavioural control).
Step 2: The expected intervention outcome is to support PLHIV in the adoption of 3 health- promoting behaviours. A matrix of objectives was created where performance objectives meets the determinants of behaviour.
Step 3: Theory-based intervention methods and specific techniques/strategies (such as tailoring, problem-solving, action planning, modeling and reinforcement) were selected to change the targeted determinants of behaviours.
Step 4: The intervention sequence and content were developed. TAVIE en santé addresses smoking cessation, physical activity and healthy eating. It is composed of web sessions, hosted by a virtual nurse, that aim to develop and strengthen skills required for behaviour change. Based on an algorithm using individual cognitive data (attitude, perceived behavioural control and intention) the number of sessions planned, theory-based intervention methods used, and message content generated are tailored to each user.
Step 5 involves implementing the intervention and step 6 in evaluating it.

Media development:
The clinical content was validated by health professionals and then transposed in the form of web pages. Many teams were involved in the media development: multimedia productions, graphic design, and computer programming. The TAVIE platform offers a content management system that facilitates the integration of media files. TAVIE en santé required a computer algorithm to be engineered in order for the intervention to be tailored to each user.

Demonstration: A short demonstration of the different features of TAVIE en santé (i.e., videos of the virtual nurse, animated narrations, consolidation tools) will be conducted.

Conclusion: The effectiveness of TAVIE en santé is currently being evaluated in an online randomized control trial (NCT02378766). This intervention constitutes an accessible complementary service in support of existing specialized services. In a time where medical resources are limited, this web-based nursing intervention could be a promising avenue for health behaviour change.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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4. A survey to examine public perceptions and use of social media for health information

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Rationale: Finding innovative ways to encourage and motivate the public to make positive health decisions has never been more important.(1) The popularity of social media; used by members of society regardless of age; ethnicity; or socioeconomic status (2), may offer healthcare professionals an opportunity to reach those people who are normally reluctant to seek support. Combining this medium with evidence-based behaviour change theory presents a unique chance to improve population health.

Aims: To evaluate Greater London public perceptions and use of social media for health information.

Methodology: Following a literature search a survey tool was created consisting of 26 items. A range of question types were included: multiple-choice; check-boxes; and a 5-point likert scale to rate statements from 1 (disagree) to 5 (agree). The majority of answers were pre-formulated with an "other" option provided to allow respondents to write alternative answers in a free text box. The required sample size (confidence level 95%; margin of error 5%) was calculated using raosoft sample size calculator. Ethical approval was obtained from the university ethics committee. Data was analysed using Excel.

Results: The survey was completed by 466 respondents (required sample size=385). The most popular social media platforms used were Facebook (85%); YouTube (62%); Instagram (54%); Snapchat (45%); and Twitter (44%). Over 40% (41.4%) had used social media to search for health information instead of speaking to a healthcare professional (46% of all females vs. 38% of all males; 44% of all under 35s vs. 35% of all over 35s; 43% of all non-white vs. 39% of all white). Reasons for preference of social media included: takes less time (66%); more convenient (46%); and less embarrassing (34%). The majority (85%) found the information they were seeking on social media almost instantly or within a few minutes. Only 3% did not find what they were looking for. Nearly three-quarters (71.2%) felt that the information was reliable and the majority (87.8%) found it useful. Over 40% (40.9%), however, did not know how to apply it to their personal health situation. Less than two-fifths (38.2%) were aware of the information sources used by social media health pages and just over half (53.2%) checked the reliability of the information with a healthcare professional who agreed with it on only 52% of the occasions. Most (70.2%) stated that if a social media page was created and maintained by healthcare professionals, they would use it.

Conclusion: The public use social media for health information regardless of age, gender or ethnicity. Many are unaware of the accuracy of the information they access and few check its reliability. Embedding health behaviour change theory into a social media page created and maintained by healthcare professionals would ensure the public have access to evidence-based information that encourages positive health outcomes.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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5. Using the Behaviour Change Technique Taxonomy v1 to conceptualize the clinical content of Breaking Free Online: A computer-assisted therapy programme for substance use disorders

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Rationale: Research within health psychology has made significant progress in advancing and standardising the science of developing, evaluating and reporting complex behavioural change interventions. Part of this work has involved the development of an evidence-based Behaviour Change Technique Taxonomy v1 (BCTTv1), which describes the 'active ingredients' contained within such interventions. To date however, this standardised approach to describing intervention content has not been applied to complex interventions for substance use disorders (SUD).

Aims: This paper uses Breaking Free Online (BFO), a computer-assisted treatment programme for SUD, as an example of how clinical content contained within SUD treatment interventions might be accurately described using the BCTTv1. The purpose of this exercise was to demonstrate how the BCTTv1 might provide a common language for describing the active components of SUD behaviour change interventions. Such a common language may facilitate the effective and precise delivery of complex multi-component interventions within the field of SUD thereby enhancing fidelity of delivery, and enhancing replicability and synthesis of intervention content in evaluation studies.

Methodology: This was a focus group study to elicit trained behavioural-science researchers' opinions around the behavioural change techniques contained within the clinical content of BFO and how these techniques may be most accurately described by the BCTTv1.

Analysis: The developers of BFO produced a comprehensive list of the clinical content of BFO. Mapping of the clinical content of BFO onto the BCTTv1 was then conducted separately by each researcher, including the BFO developers and psychologists working within SUD treatment. Each researchers' list of BCTTv1 codes describing the BFO clinical content was then combined into one coded list which was reviewed by all researchers. Any discrepancies in the coding were discussed between researchers until agreement was reached.

Results: When the BCTTv1 was used to describe the clinical content of the BFO programme, it was found that of the 16 grouping categories of behavioural change techniques in the BCTTv1, clinical content of BFO mapped on to at least one behavioural change technique in 12 out of these 16 grouping categories. In total, 26 out of 93 available BCTTv1 behavioural change techniques were identified in the clinical content of BFO.

Conclusion: This exploratory mapping exercise has identified the specific behaviour change techniques contained within BFO, and has provided a means of describing these techniques in a standardised way using the BCTTv1 terminology. It has also provided an opportunity for the BCTTv1 approach to describing intervention content to be reported to the wider SUD treatment community, as the BCTTv1 has not previously been used to describe clinical content of an SUD intervention. Such an approach may have utility in the development and evaluation of other complex behavioural change interventions within SUD. A Delphi study is currently planned with professionals working in the field of SUD treatment, to continue to map the BCTTv1 onto the psychosocial techniques contained within the BFO programme. Further behaviour change interventions are also under development, by the creators of BFO, with future work planned to conceptualise the content of these using the BCTTv1.

Conflict of Interest: The authors are employees of Breaking Free Group where the Breaking Free Online treatment programme is developed.

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6. Developing e-learning resources for families of African-Caribbean people diagnosed with schizophrenia: A qualitative approach to co- production

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Rationale: African-Caribbean people in the UK are more likely to be diagnosed with schizophrenia than any other ethnic group. They report high levels of stigma and shame about mental illness. This contributes to delayed help-seeking and worse outcomes such as high rates of relapse. Stigma combined with comparatively inferior access to services increases the duration of untreated illness and is associated with more coercive care, including disproportionally high rates of hospital admissions, higher doses of medication and increased likelihood of being held in seclusion. African-Caribbeans' negative experiences of mental health services have created a 'circle of fear' towards engaging with statutory mental health services. Delayed access to diagnosis and care contribute to high levels of burden and tension within families living with schizophrenia.

Aims: Psychoeducation has shown potential for improving outcomes for patients, families and caregivers. However, there are no culturally-appropriate psychoeducation programmes for African-Caribbeans. The aim of our study is to inform the development of a culturally- appropriate e-learning resource and to test its feasibility and acceptability among African-Caribbean families.

Methodology: As no information of African-Caribbean stakeholders' views of culturally-appropriate learning resources for schizophrenia is currently available, collecting qualitative data was essential. Using a topic guide developed from the literature and refined by patient and public involvement (PPI), we conducted focus groups comprising i) persons diagnosed with schizophrenia, ii) carers and family members and iii) community members.

Analysis: Framework analysis was conducted with NVivo. The framework was constructed by identifying participant groups' responses to a priori themes. Additionally, emergent themes and subthemes were coded to inform resource development of content.

Results: There were ten a priori key themes, e.g. 'need for the resource', 'content for the resource', and 'culturally sensitive issues'. Five other themes outside the topic guide emerged from the data, including 'self-acceptance' and 'police involvement'. Findings showed that all groups perceived a strong need for a culturally-appropriate resource on schizophrenia. There were similarities and differences in content preferences between the groups. For example, all three groups prioritised stigma, medication, and spirituality. Patients considered relationships also as a theme of high importance. In contrast, family and community members highlighted the need for psychoeducation aimed at raising awareness about schizophrenia at a community level. Both family and community participants also perceived a need for better understanding of symptoms and personal recovery stories to counteract negative beliefs and attitudes.

Conclusions: Our findings demonstrate that African-Caribbeans living in Greater Manchester perceive the need for a culturally-appropriate learning resource about schizophrenia and psychosis. This highlights the community's desire for a better understanding of mental illness to improve patient and family outcomes and reduce stigma.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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7. Can existing apps support healthier food purchasing behaviour? Assessing the integration of behaviour change theory and user quality components in mobile apps.

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Rationale: Supporting healthier food purchasing behaviour is a key objective of many dietary interventions but achieving long-term change has proven difficult. As elements of food purchasing behaviour are considered habitual, it is argued that a greater utilisation of habit theory in intervention design is needed to achieve sustained change. A number of potential intervention strategies have been proposed by van't Riet et al. (2011). Another important stage of intervention development is identification of an appropriate delivery mode. Recent evidence suggests that mobile apps offer a potentially effective approach to delivering behaviour change interventions in the food domain. However, some apps fail to adequately integrate behaviour change theory or user quality components which may limit their effectiveness. To date, no assessment has been made of their integration in food-related apps.

Aim: The aim was to assess existing mobile apps on their integration of user quality components and behaviour change theory relevant to food purchasing behaviour.

Methodology: A descriptive comparative assessment of mobile apps was conducted. Using pre-defined exclusion criteria a sample of twelve apps were assessed. User quality was assessed using the Mobile App Rating Scale (MARS). Behaviour change techniques (BCT's) (Michie et al., 2013) were assigned to each proposed strategy and used to score apps on their integration of theory.

Analysis: The number, median, and type of techniques integrated were calculated. The median was calculated for the total MARS score and each MARS sub-scale. Spearman's correlation examined the relationship between integration of behaviour change theory and user quality components.

Results: Findings suggest a lack of focus on food purchasing behaviour with most apps focusing on behavioural outcomes, such as weight management. Integration of behaviour change theory was adequate with an average of three BCT's present in the selected apps although their integration ranged from 2 - 16. The most popular techniques were goal setting (outcome of behaviour), self- monitoring of outcome(s) of behaviour, and conserving mental resources. 25 techniques were not present in any mobile app. User quality was good with an average MARS score of 3.8 out of 5. Lowest average scores were associated with the engagement (3.4) and information (3.7) categories. No significant relationship was seen between integration of behaviour change theory and user quality components (rho = 0.046, p = 0.89).

Conclusions: Existing mobile apps could play a role in supporting healthier food purchasing behaviour but improvements in app design are needed to maximise effectiveness. A greater integration of techniques directly relevant to food purchasing behaviour rather than behavioural outcomes may be beneficial. Future research should examine why particular techniques are not integrated and assess potential for future inclusion. While existing apps appear to integrate behaviour change theory and user quality components they do so to a disproportionate extent with a continued focus on one element over the other. This may diminish the user experience and limit potential effectiveness. As it is unknown which component contributes most to the user experience, future work should assess the importance of these components to the consumer to inform effective intervention development.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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8. Beat the Street – Harnessing Digital Technology for population level changes in Physical Activity

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Introduction: Intelligent Health delivers 'Beat the Street' with the aim to get a whole community more physically active. Beat the Street turns the town into a real-life game where players register their walking and cycling journeys by tapping a smartcard on around 220 RFID readers called 'Beat Boxes' placed on lampposts around the town. Players monitor their progress via a website where they can see their own and their team's progress, and the overall target.

Methods: Participants are recruited through and via schools, receiving a smartcard for themselves and family members from their teacher and a map of Beat Box locations. Recruitment also takes place from community groups, workplaces and GP surgeries. Participants who are not pre- registered through their school register online. During the registration process players are able to pick a team for their points to be awarded to. 10 points are awarded for every valid journey between two Beat Boxes which are placed at key destinations across the town, approximately 0.5 miles apart. Points contribute to individual and team scores.

During registration, participants complete a questionnaire which includes a single item physical activity question. follow up surveys take place at the end of the game and up to 8 months later. Pre-intervention/post-intervention comparisons are completed based on survey responses and in-depth analysis is completed based on data from each players activity tapping their card on beat boxes. This data is used to validate changes in physical activity between baseline and follow-up and used to map levels of physical activity across a community to develop targeted interventions post game phase. Swipe data is delivered in real-time and used to refine the intervention throughout the 7 week game, whereby efforts are made to increase levels of activity in areas of low beat box activity.

Results: In 2015, Intelligent Health delivered 11 Beat the Street projects, engaging 170,000 partici-pants and collected baseline survey data from 45,136 adults. In 2016 prior to September, In-telligent Health delivered 15 Beat the Street projects, and reached the milestone of 500,000 people engaged and collected baseline survey data from 53,234. Intelligent Health currently has 7 live projects therefore these engagement figures will rise substantially by the end of 2016.
Beat the Street has 3 key performance indicators, reducing levels of physical inactivity, in- creasing the proportion of people meeting the Chief Medical Officers physical activity guide- lines of 5 days of moderate to vigorous physical activity lasting 30 or more minutes per week, and increasing the proportion of people using active modes of travel on 5 to 7 days per week. In 2015, across all Beat the Street projects the proportion of people reporting 0 or 1 days of physical activity decreased from 14% before Beat the Street to 8% after. The proportion meeting CMO guidelines increased from 43% to 48%, and the proportion of people walking for 15+ minutes increased from 54% to 63%. In 2016, prior to launch of the 7 currently live games, across all Beat the Street projects the proportion of people reporting 0 or 1 days of physical activity decreased from 8% before Beat the Street to 1% after. The proportion meet-ing CMO guidelines increased from 46% to 57%, and the proportion of people walking for 15+ minutes increased from 47% to 61%.
Are the changes sustainable?
In February 2016, Beat the Street was launched in Isleworth, sited in the London Borough of Hounslow in West London, and recently in September the game was re-launched across the whole of Hounslow. Matched data was available for 244 people from the Isleworth registration and the Hounslow registration 7 months later. During this time the average number of days that people were physically active increased from 4 to 5 ($P < 0.01$), with a trend towards those not meeting CMO guidelines at Baseline (February) to meeting them 7 months later (See Figure. Furthermore, focussing on the inactive, an enormous shift in physical activity was discovered for those reporting 0 or 1 days of physical activity in February compared to their self-reported levels of physical activity 7 months later.

Discussion and Conclusion: Intelligent Health's analysis from the 26 completed Beat the Street projects to-date suggests that the concept of turning a whole community into a game leads to immediate changes in population levels of physical activity. Matched analysis indicates that these changes may be sustained at least 7 months later.
Further analysis to measure the wider benefits of using novel technology to create population level changes in physical activity is currently underway. At present, during live Beat the Street projects, Intelligent Health are currently conducting a pre-test/post-test comparison of mental wellbeing, using the Warwick Edinburgh Mental Wellbeing Scale, in Stranraer

Scotland, where 39% of the population are engaged in Beat the Street. The Short form Warwick Edinburgh Mental Wellbeing Scale is being tested in Salford, Manchester, and social cohesion and social networks are being evaluated in Hounslow, London. Matched data analysis on these wider benefits will be available for presentation at the conference, as well live beat box data from projects due for launch in February 2017.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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9. Does inclusion of craving management tools increase effectiveness and usage of a stop smoking app? Results from BupaQuit trial.

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Rationale: Cigarette cravings play an important role in relapse during attempts to stop smoking. Smartphone applications (apps) targeting cravings may reduce the risk of relapse but this has yet to be assessed empirically.

Aims: This study aimed to evaluate the effectiveness of a smartphone app that that included craving management tools (BupaQuit) versus a similar app that did not include them.

Methodology: The study was a two-arm parallel and double-blind randomised controlled trial (RCT; trial registration: ISRCTN10548241) comparing a fully-automated app, BupaQuit, which included craving management with a version of the app without these tools. A total of 425 adult UK-based daily smokers were recruited remotely, individually randomised within the app to receive the intervention (n=208) or control (n=217), and followed up through the app, email or phone. The primary outcome was self-reported 14-day continuous abstinence from smoking, assessed at 4 weeks after the quit date. Secondary outcomes included app usage and remotely biochemically validated abstinence using personal CO monitors. The study was approved by UCL Research Ethics Committee.

Analysis: The primary outcome was assessed with fisher's exact test using intent-to-treat (ITT) analysis. Usage indices were analysed using negative binomial regression. The analyses were performed in SPSS 22.0.

Results: There was no significant difference between intervention and control arms in self- reported 14-day continuous abstinence rates at 4 weeks (13.9% vs 15.7%; RR=.89, 95%CI=.56- 1.41) or number of logins (mean= 9.6 vs 10.5; median=4 vs 5), but intervention participants spent significantly more time using the app (402 vs 326 seconds). At follow-up, 53.8% of participants were reached, of which 11.4% were contacted through the app and 78.6% through the phone. Only a quarter of participants who self-reported abstinence returned a CO readings.

Conclusions: The addition of craving management tools in BupaQuit did not increase app effectiveness. Remote validation of abstinence using personal CO monitors was not successful.

Conflict of Interest: AH is funded by British Heart Foundation PhD Studentship, JB by Society for Study of Addiction, HKU by National Centre for Smoking Cessation and Training, EB by NIHR School for Public Health Research, and RW by Cancer Research UK. AM was employed at Bupa. BupaQuit app development and trial costs were funded by Bupa. The founders had no impact on study design, outcome data collection, data analysis or presentation of findings.

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10. The Final Mile: An Evaluation of Essential Patient Engagement and Self-Efficacy for Older Adults to Facilitate Digital Health Interventions

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Rationale: Despite the prevalence of digital health and empirical evidence strongly supporting improved health outcomes and the potential for cost saving efficiencies in the health sector--the final mile--as it is sometimes called, is the sustained patient engagement through adoption and use we have yet to achieve. While health endures as a term to describe looking after oneself, looking after loved ones, and receiving care, the added component of electronic technology has emerged to affect all levels of health care delivery. The combination of digital technology and health services are designed to provide improved care with the potential to change the way we live our lives. Although digital health interventions hold the promise of positive health outcomes, an emerging theme in the literature suggests those most likely to benefit from digital health are least likely to utilize it.

Aim: The purpose of this study is to gain a deeper knowledge of attitudes toward use, potential external variables that affect use, and how older adults perceive and are challenged by digital health utilization through an interdisciplinary applied approach. This study identifies the gap in the literature of understudied characteristics of digital health adoption and use affecting the aging population in the US. The findings of this study will enhance the existing literature and inform future research.

Methodology: The procedures and methods implemented to identifying prevalent barriers to digital health utilization by an aging population utilized a three-phase mixed methods design with participants from the University of Massachusetts, Boston's Osher Lifelong Learning Institute (OLLI) program. A sample from a larger population of 1200 OLLI members was engaged The approach engaged individuals born between the years of 1925 and 1965 to provide valuable quantitative and qualitative evidence for analysis.

Data collection occurred during the six-months from March 2016 to September 2016, and a Pre- Post strategy was used to empirically test a training and educational health-related technology intervention. The pretested scoring instrument was theoretically grounded in the TAM model of acceptance and use of technology. The TAM analytic framework underlying this work represents a decision 'core' as a user pathway for actual use. Additionally, brief semi-structured interviews added a qualitative component to the study to capture the lived experiences of the participants and identify lesser known barriers to use. This work followed the appropriate standards of ethics in research with an approved IRB protocol.

Analysis: By studying this population born between 1925 and 1965 through a mixed method analysis, the characteristics and efficacy of digital health acceptance and use for aging generations in Boston was illuminated using a quantitative test of differences. Thematic coding was employed for a qualitative analysis. Using age, which emerges from the literature, as an indicator of online performance and information utilization, combined with the TAM analytical framework assessing perceptions and attitudes, this research contributes a deeper understanding of the key barriers to utilization of health-related technology.

Results: The results from this study are two-fold. The work strongly suggests specific barriers to adoption and use, confirming a distrust and reluctance to engage. However, additional evidence, both quantitative and qualitative identifies available skills, positive perceptions, encouraging attitudes, as well as available resources.

Conclusion: In the United States, older adults born between 1925 and 1965 demonstrate high levels of interest and ability in gaining skills to interact with their healthcare. The addition of an educational component greatly enhances engagement with health-related technology adoption and use relative to initial measured perceptions and attitudes toward its use. This current research offers insight and specificity for a two-pronged approach to foster health-related technology engagement benefiting future interventions.

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11. The "application" of Facebook as a research tool to explore human behaviour and the self-coding done by "participants"

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Rationale: Alcohol misuse can negatively impact on the physical, psychological, social and financial aspects of individuals, their families, and society. Recent figures from the Organisation for Economic Co-operation and Development (2015) rank Ireland fourth out of its 34 member countries for annual consumption. In light of this and the dramatic increase in alcohol related morbidity and mortality in the 18-29 age group and reports such as one in four Irish people disclosing they have experienced harm as a result of someone else's alcohol consumption (Hope 2014), alcohol misuse especially among young adults has been identified as a public health priority. It has been suggested that Social Networking Sites (SNSs) expose important information about how young adults are interacting with one another. It has also been suggested that it is also possible to learn about the behaviour of individuals through what they choose to display publically on SNSs.

Aim: As part of a wider research project to inform the development of an intervention to address the issue of alcohol misuse by young people in the context of social media in the Republic of Ireland, a study to describe the shared patterns of behaviours and language of young adults on Facebook in Ireland with regard to alcohol has been undertaken.

Methodology: A virtual ethnographic approach using non-participant observation was utilized to follow the interactions of participants on Facebook. Purposive sampling was used to identify participants aged 18-29 years old, living in the Republic of Ireland and who had a publically available Facebook profile. Permission to conduct this research was granted by the Filter Committee of the Health Research Ethics and Governance Committee at Ulster University. Using a codebook specifically developed for the study the content on each participants' profile over a 30-day period was reviewed for e.g. textual comments, pictures and down loaded icons for any references in relation to alcohol.

Analysis: Data collection and content data analysis will be completed by December 2016.

Results: Some of the preliminary recurrent themes emerging from the data regarding conversations of interest relating to alcohol consumption include; planning alcohol drinking activities, negative effect/consequences of alcohol consumption, reaching the legal age for alcohol consumption, special occasions.

Conclusion: Conclusions and recommendations will be presented once full data collection and analysis is complete. In addition to providing findings from this observational study the researcher will also report some of the challenges that were encountered when utilizing Facebook as a data collection tool.

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12. Investigating the influence of wearable activity- tracking technologies on behaviour change in people aged 55 and over

Shailey Minocha[1]*, Duncan Banks[1], Caroline Holland[1] and Jane Palmer[2]
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Our research project (http://www.shaileyminocha.info/digital-health-wearables/) at UK's Open University and in collaboration with Age UK Milton Keynes aims to investigate whether behaviour changes in people aged over 55 years through the use of wearable activity-tracking technologies. Example technologies include those from Fitbit, Jawbone, or smart watches from Apple or Samsung. Typically, these devices record steps walked, sleep patterns, or calories expended.

The benefits of regular physical activity for older adults and those with chronic disease and/or mobility limitations are indisputable. Regular physical activity attenuates many of the health risks associated with obesity, cardiovascular disease, diabetes, depression and anxiety, and cognitive decline. As physical activity levels among older adults (both with and without chronic disease) are low, facilitating an increase in activity levels is an important public health issue. Walking has been identified as an ideal means of low-impact, low-risk physical activity that can boost physical and mental wellbeing. An author of a recent study said: "Physical activity may create a 'reserve' that protects motor abilities against the effects of age-related brain damage". Walking has been shown to improve cognitive performance in older people. Our previous research has shown that walking with others can help reduce social isolation and loneliness among people aged 55 and over.

In our year-long project (May 2016 – April 2017) and funded by the Sir Halley Stewart Trust, we have given activity-trackers to 17 participants in the age range from 55 – 80. Through monthly workshops, diaries that the participants are maintaining and sharing with us on a weekly basis, and through one-to-one interviews with them, we are investigating how the behaviours of our participants is changing – whether there is an increase in their activity such as walking or gardening, lifestyle changes, attitudes towards food/diet, and so on. There is already some evidence emerging such as: increase in activity levels in all the participants; increased awareness of food intake; and sharing of data with the GPs to diagnose the non-optimal sleep patterns (one of them now has a treatment plan in place for poor sleep). A couple of participants have joined the gym when they realised that their desk-based work-life doesn't give them the opportunity to stay active during the week.

In addition, we have conducted two surveys: the first survey is aimed at people aged 55 years and over who are already using these devices - to investigate their experiences and the changes in their behaviours that they perceive; and the second survey is aimed at medical professionals to explore whether they use the data from these devices for diagnosis and intervention. Most importantly, do medical professionals use data from these devices to determine the behaviour or lifestyle changes in people aged over 55 years?

Full results of the project will be available by the time of the conference. The Open University's Human Research Ethics Committee has approved the research design of this project (HREC/2016/2191/Minocha/1).

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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13. The Old Man (or Woman) and the App: Crossing the digital divide and bringing an adherence app to elderly patients who have no prior experience with tablets or smartphones

Talya Miron-Shatz, Phd[1]*

[1] Founding Director, Ono Academic College, Israel

Rationale: The rational for this study is the increasing prevalence of digital health, alongside the realization that, for some populations, it is not readily accessible. We have set out to examine:

- Whether older people use digital health,
- Whether there is a way for such patients, even with no prior smartphone or tablet experience, to benefit from a digital health interventions, and
- Whether said patients would prefer a more traditional, pen and paper journal, adherence intervention.

Methods:

Study 1: Between 2010-2012, the mobile application "Medication Plan" could be downloaded free of charge from the Apple-App-Store. It was aimed at supporting the regular and correct intake of medication. Demographic and health-related data were collected via an online questionnaire. This study analyzed captured data. We analyzed results from 1799 users (74% male, median age 45) for whom data was captured. For this observational study, the DV was frequency and length of using the app.

Study 2: Coronary heart disease patients (N= 24, 50% male, mean age 73.8) with no prior experience with smartphones or tablets, received a tablet with the 'medication adherence' app, and an introductory tutorial session. They used the app for a month, and (in randomized order) also used a pen and paper adherence journal. The patients were recruited from local clinics via cardiac-rehab sports groups (we approached 100 patients), in 2015.

Results:

Study 1: Variance analysis showed a significant effect of the users´ age regarding duration of usage (p = 0.025). On average, users under 21 used it for 23.3 days. Usage increased with age, up to users age60 and above (103.9 days). "Daily usage intensity" increased with number of prescribed medications, from an average of 1.87 uses per day and 1 drug per day, to 3.71 uses per day for users taking over 7 different drugs daily (p<0.001). The results clearly indicate that, with age, as well as with drug regimen complexity, the loyalty to a medication adherence app increases. This has encouraged us in carrying out Study 2, which deals with older, and smartphone/tablet naïve patients.

Study 2: Baseline mean subjectively assessed adherence was 50.0 (SD=3.44), and increased after the digital intervention (54.0; SD=2.01), more than after the paper system (52.6; SD=2.49) (for all pairs, P<0.001). Logging data showed significantly stronger adherence for the app than the paper system for both blood pressure recordings (P<0.001) and medication intake (P=0.033). Almost all participants wanted to integrate the medication app in their daily lives and required no further assistance with it.

Conclusion:

Study 1: Patients age 60 and over engage in prolonged use of an adherence to medication app. Across ages, usage increases with complexity of medication regimen. This suggests that digital health solutions are required, and adopted, including by patients who are slightly older, albeit self-select to download an app.

Study 2: The results show that, despite being digitally naïve, elderly patients were capable to use an adherence app, which increased their adherence to medication and to blood pressure measurements. Granted, the patients received a home-visit during each phase of the study, and the tablet applications were hugely simplified for them. However, following this initial training session, the patients used the app, benefited from it. and preferred it to a pen and paper system.

Thus, bridging the digital age gap is possible, and can lead to health improvements. That said, an offline component might need to be added, alongside modifications in the mode of delivering the intervention, to truly accommodate patients' needs. The results show the great promise of digital health in a scalable manner, as well as the modifications that need to be carried out for it to reach its full potential, including among the older and the less tech-savvy.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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14. Health apps - could we be just one, critical step away from the most effective form of intervention in the history of public health?

Paul Nash[1]* and Barbara Marshall[1]*

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Background: Preventable death and ill-health due to lifestyle-related chronic disease is one of the biggest public health challenges of the 21st century. Almost half of global deaths are attributable to the lifestyles we choose to live as individuals - is it going too far to coin the phrase 'sleepwalk suicide'?

Health apps are uniquely accessible to mass populations - financially, globally and socially. Their quality and efficacy however are notoriously variable, unpredictable and unregulated. Unlocking the unquestionable potential of health apps as a powerful public health intervention now relies on elevating ourselves from the free-for-all, anyone-can-have-a-go market that we're rapidly growing tired of to a genuinely credible, respected elite of preventive health interventions.

Description of Application: Quealth www.quealth.co is a highly validated, evidence-based health improvement intervention that focuses on the prevention of five leading non-communicable diseases: diabetes, cancer, chronic obstructive pulmonary disease (COPD), dementia and cardiovascular disease (CVD). Quealth is also one of the most accurate predictors of disease, with its algorithms for diabetes, CVD and COPD achieving AUC values of between 0.77-0.80.

Quealth's health journey includes five interactive modules - health assessment, health planning, health coaching, health tracking and health motivation, which seamlessly integrate to provide an engaging, empowering user experience that drives positive and sustainable health outcomes.

By assessing the answers given to a series of questions, covering family medical history, biometrics and lifestyle, Quealth's algorithms calculate the disease risk for each of the five conditions. The output is a single score, based on a relative risk model. In addition, Quealth has the ability to aggregate data from >250 of the world's most popular devices with this real-time data leading to an instant impact on the Quealth score.

Quealth is governed by an active, ongoing programme of formal clinical validation, supported by our Clinical Advisory Panel and in partnership with leading academic institutions.

Benefit of Application: Paul will present the efficacy of Quealth as a digital behavioural change intervention both in its own right and as a socially, geographically and financially accessible alternative to more traditional approaches to preventive health management.

Paul will then explore the key and emerging determinants to unlocking the public health potential of health apps, including:

- the application of evidence-based behavioural science
- the integration of artificial intelligence technology
- the gold-standard regulation and accreditation of health apps
- outstanding design and
- global distribution.

Conclusion: Rightly or wrongly, one thing sits at the centre of more people's lives, across all demographics than anything else - the smartphone. It has both omnipotence and influence - two critical requisites for affecting the behaviours of mass populations. Tiny nudges in health behaviours can have significant personal impact - and massive impact at population level. We haven't got it right yet. But if we can, we may well have public health gold literally in the palm of our hand.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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15. LIFE: Life-saving Instruction for Emergencies, a serious game for mobile devices and VR

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LIFE (Life-saving Instruction for Emergencies) is a serious game for mobile devices and Virtual Reality gaming systems that will teach healthcare workers to identify and manage medical emergencies. LIFE uses game-like training techniques to reinforce the key steps that need to be performed in order for a healthcare worker to save lives.

LIFE is based on an existing face-to-face training course called ETAT+, developed in Kenya in 2006 (Irimu et al, 2008), that extended a WHO approach to help introduce evidence based care for life-threatening neonatal and paediatric conditions in rural hospitals. The ETAT+ training was adopted as part of UK RCPCH's flagship projects in East Africa in 2011 and is now used across Kenya, Uganda, and Rwanda, and has been introduced to Zimbabwe, Zambia, Malawi, Tanzania, Sierra Leone and, most recently, Myanmar. Overall, face to face ETAT+ has been provided to over 5000 healthcare workers and 2000 medical students. The paediatric care guidelines it is linked to have been updated 3 times most recently in 2015 and distributed to over 40,000 healthcare workers in Kenya.

Smartphone adoption in Kenya and other African countries is growing rapidly, especially among healthcare professionals (Kumar, Paton and Kirigia, 2016). By deploying training over the users' own smartphones, LIFE has the potential to reach far more healthcare workers than face to face training can alone (Edgcombe, Paton and English, 2016) and care has been taken in our design to ensure that learning interactions are pedagogically appropriate.

This presentation will demonstrate the first scenario we have developed for the LIFE platform called 'Neonatal Resuscitation'. The scenario takes place in a Kenyan hospital where the user learns how to manage a medical emergency in which a newborn baby is not breathing.

The game combines graphics developed by Leti Arts, an African design studio, with a 3D virtual hospital, developed at the University of Oxford. Users answer a series of questions and interactions in order to progress through the game in order to gather together the correct equipment needed for resuscitation and to perform the correct series of steps needed to complete a successful resuscitation.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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16. The efficacy of an integrated approach to workplace health and wellbeing on physical and mental health markers of an Australia workplace population.

Paul Taylor[1]*

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Rationale: Australia faces an increasing health crisis, with significant incidence of lifestyle-driven diseases, such as obesity, diabetes and cardiovascular disease. A common link between these conditions is the metabolic syndrome, which increases risk of cardiovascualr disease by between 200% and 300% - incidence in Australia was reported to be 19% of Adults over the age of 25 in the AusDiab study of 2000. Public health interventions have consistently failed to address the issue and there is some evidence that workplace health interventions may be more successful at changing behaviours. It has also been shown that some gamification strategies may be useful in assisting with health behaviour change, but there is a paucity of research in workplace interventions that use a combination of health education across several areas and gamification strategies to effect health outcomes.

Aims: The aim of this project was to assess the efficacy of an integrated approach to workplace health and wellbeing on physical and mental health markers of an Australia workplace population.

Methodology: 22 groups of workers were recruited in a 12-week experimental design with individuals acting as their own controls. Participants took part in a 2-day lifestyle education and behaviour change workshop and were given access to a website and APP that utilised a number of gamification strategies and other behavioural change tools. They were also provided by gym memberships and 2 health coaching sessions. Outcome measures were BioAge testing (commercial software that created an age from a number of different fitness measures and lifestyle questions) and the following makers:

- Total cholesterol, HDL, LDL, LDL particle size analysis
- Triglycerides
- Omega 6:3 ratio
- Blood pressure
- Fasting blood glucose
- Body composition – weight, waist circumference and BMI
- Metabolic syndrome
- Psychological Capital wellbeing survey
- Gallup G-12 workplace engagement survey

Ethical approval for the study was granted by Victorian ethics.

Analysis: LDL particle size testing was performed by Invitalab in Germany, and all other blood tests were analysed by a local Australian pathology laboratory. Blood pressure and all physical tests were performed by qualified exercise physiologists, and the k-10, Psycap and G-12 questionnaires were filled out by participants under supervision.

Results: At the start of the study, 19 of the 22 participants met the criteria for the metabolic syndrome. At the end of the study, no participants met the criteria. Bioage reduced by an average of 8.3 years ($p<0.01$); average weight reduction was 9Kg or 8% of bodyweight ($p<0.01$); waist circumference reduced by 12cm or 10% ($p<0.01$); BMI reduced by and average of 2.92 points or 8% ($p<0.01$). Systolic blood pressure reduced by an average of 16.5 mmHg or 12% ($p<0.01$) and diastolic blood pressure reduced by 8.2 mmHg, or 9% ($p<0.01$). Total cholesterol did not change significantly, but HDL increased by 21% ($p<0.01$), Triglycerides reduced by 33% ($p<0.01$), Omega 6:3 ratio improved 34% ($p<0.01$) and LDL reduced by 38% ($p<0.01$). In terms of LDL particle size, the pathogenic LDL 3 reduced by 52% ($p<0.01$) and pathogenic LDL 4 by 84% ($p<0.01$). No other changes were noted in LDL particle size. Average PsyCap scores improved 12% ($p<0.01$) and Q12 improved 9% ($p<0.01$)

Conclusions: The use of web and APP-based gamification strategies appears to be effective in improving both physical and mental health markers of health in workplace intervention programs, whilst enhancing workplace engagement. The intervention may also be an effective tool in combatting obesity and the metabolic syndrome.

Conflict of Interest: The lead author is CEO and founder of Ritualize, the APP that participants used in the study.

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17. Project Simway: A city-wide personalized weight management intervention, mobilizing the local Community Health Volunteers (CHVs) equipped with a cutting-edge smartphone app based on Behavior Change Techniques (BCTs) framework and mathematical weight simulation in Sub-Saharan African countries

Akio Yonekura[1]*, Yoshiki Ishikawa[1] and Maiko Amino[2]
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[2]Africa Scan Co., Ltd., Kenya

The objective of Project Simway is to bring the most advanced IT technology and know-hows for large-scale weight management interventions, developed and accumulated in Japan, to Sub- Saharan African countries where the obesity issue is rapidly on the rise but the local resources haven't yet been properly equipped to manage it. Project Simway will be launched as a city-wide weight management intervention program in Naivasha, a rural Kenyan city with a population of 180,000, in January 2017, fully supported by Naivasha's Ministry of Health. The project is expected to be expanded to other Kenyan cities in 2018 after the successful launch in Naivasha, and then to other Sub-Saharan African countries in the following years.

The key component of Project Simway in Naivasha includes 1) a cutting-edge smartphone app, called "Simway" developed by Campus for H Inc, based on BCTs framework and mathematical weight simulation that creates and follows up personalized weight management plans, 2) the entire 500 Community Health Volunteers (CHVs) in Naivasha, who have been appointed by the local government to improve the community public health, to use Simway and work as health coaches to conduct personalized weight management interventions in their communities and 3) Campus for H Inc to conduct on-the-ground trainings to CHVs so that they can run effective intervention programs based on the latest public health evidences. Campus for H Inc will distribute smartphones with Simway app pre-installed, weight scales and measuring tapes to all the 500 CHVs in Naivasha so that they can conduct the most primitive version of metabolic syndrome assessment in their communities to identify overweight individuals. Each CHV is currently in charge of one community consisting of approx. 100 households and will manage weight management plans for approx. 100 individuals in the community. (Simway app is currently available only in Japan and Kenyan version is under development for its January 2017 launch.)

Simway app has 2 different versions for 2 different types of users:
One version is "Simway CHV" which enables CHVs to design a personalized weight management plan for each overweight individual (dieter) in the community, track all the individuals' everyday progresses and interact with any one of them when necessary. Simway CHV takes care of all those functions just in one app. It is also equipped with Campus for H's proprietary mathematical algorithm to calculate accurate personalized energy consumption/intake targets (kcal) for a given weight reduction goal. The algorithm is capable of calculating the calorie targets not only for reducing the weight but also for maintaining the weight so that the dieters could understand the required lifestyle changes (after successful weight reduction) to maintain the new weight when designing their weight management plans in the beginning.

The other version is "Simway Dieter" which applies effective BCTs for weight reduction and enables dieters to easily self-monitor one or two weight reduction behavior goals everyday (e.g. cook rice/maize without adding oil) designed by the CHV and committed by themselves. CHVs can track which one of their dieters is doing/ not doing/ not reporting their behavior goals in real time, using Simway CHV app, and communicate with those dieters (through a messaging function of Simway) who can't keep up with their promises. CHVs are expected to provide health coaching supports such as providing diet tips, changing the behavior goals and etc. through the app's messaging function. Simway Dieter also enables dieters to receive weekly weight reduction tips and to review their progress.

Project Simway applies a carefully designed incentive system. Dieters are incentivized to report if they have done their everyday behavior goals; regardless of having done it or not for the day, the dieters get the same amount of "Simway Points" which can be used to apply to Simway Monthly Lottery (chance of winning $100). With this system, the dieters are not necessarily motivated to lie even when they have done their daily behavior goals. On the other hand, CHVs get more Simway Points when their dieters have successfully done their behavior goals so that CHVs have motivations to cheer up their dieters and further

personalize the behavior goals for unsuccessful dieters when necessary. CHVs can also get bonus Simway Points when their dieters are achieving their weight reduction goals.

Japanese version of Simway app, pilot tested since April 2016, has been highly regarded for 1) its unique usage of BCTs framework in smartphone app and 2) its philosophy of enabling community health workers to effectively/efficiently develop and follow-up highly personalized weight management intervention plans for short/long-term. In August 2016, Simway was selected as one of the 10 domestic services that Japan's Ministry of Economy officially funds to support its global expansion.

If selected as a presenter at the conference, we will be able to present all the baseline research result (BMI, blood pressure, eating/ exercise habits of adults in Naivasha), the actual Simway app, and most importantly, the first month progress of weight management intervention by Simway app in Naivasha city.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Late Breaking Abstracts

18. A virtual reality food court to study food selection and identify strategies for change: design and testing

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Rationale: Adolescents and young adults have the poorest diets in nations such as the UK and Australia. Their dietary patterns frequently include 'fast foods' with sugary drinks and consumption of other food prepared outside their home. Regular inclusion of these foods leads to higher intakes of deleterious nutrients like saturated fat, sugar and sodium.

Aims: The aim of this research was to build a realistic virtual reality food court that could be used to study food and beverage selections and ultimately develop and test educational and food environment interventions that could improve eating behaviours.

Methods: Food courts in the Greater Sydney, Australia, were sampled to include those in areas of high and low socioeconomic status in both the central business districts and the suburbs (n=14). Researchers visited the food courts and collected data on the number and type of food outlets in each court, recorded all food and beverage items for sale and their cost and information on sales promotions. All displays were photographed. Fourteen food outlets were created to simulate a typical food court. The outlets were a burger shop, fried and barbequed chicken shop, both a chain and an independent sandwich shop, doughnut shop, muffin shop, café, salad shop, juice bar, fish shop, sushi shop, a kebab shop, a shop selling Asian food, and one selling Indian cuisine. Representative menus were generated and a nutrient database of all foods and beverages assembled to include energy, macronutrients and micronutrients. The Unity® 5.4.0 gaming platform was employed to design the Food Court that was viewed with HTC Vive® goggles connected to an Asus G751JY computer. Eighteen to 30 year olds were recruited at lunch time in a university food court and offered $10 to select a meal and beverage using the virtual reality platform. A validated questionnaire using a scale from 1(poor) to 7 (best) on 'presence' within the court (that measures the ability of the person to

shift from their physical environment to the virtual one); system usability; and perceived autonomy versus control to choose; was completed at the end of the session.

Analysis: Descriptive statistics including percentages, means, median and interquartile ranges (IQR) for responses were calculated using SPSS version 22 IBM Corp, Armonk, NY.

Results: One hundred and fifty seven young adults (mean age 22.5 (SD3) years) completed the study (96% response). Sense of control, engagement and involvement were rated highly by more than 60% of participants and 58% ranked realism highly (score of ≥5) with only 8% scoring <3. Seventy percent of participants rated usability highly and subjects thought their food decisions were autonomous. The most popular shop was the Indian food followed by the fish shop but meals were selected from every food outlet. The most popular beverage was regular canned cola. Conclusions: The virtual reality food court appeared to be a realistic milieu and will be used for testing interventions that facilitate healthier behaviours such as building capacity through education, providing opportunity via policies that change food environments and providing extrinsic motivation through promotions.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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19. Using Inhibition Training to Modify Drivers' Behaviour at Amber Traffic Lights

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Rationale: Sixty-five people a day are killed or seriously injured on UK roads. Some of the most dangerous driving is habitual, activated automatically in response to environmental cues; for example, accelerating instead of stopping in response to an amber traffic light. Response inhibition training aims to replace these automatic behaviours with lower risk responses. Previous research has successfully paired images of alcohol or food with 'stop' responses, reducing alcohol consumption and junk food intake however, no empirical studies have yet investigated using response inhibition training to similarly improve driving behaviour.

Aims: To pilot the use of response inhibition training to reduce the number of amber traffic lights crossed in a driving computer game. This will be achieved by training an association between amber circles and 'braking' in the experimental group.

Methodology: Thirty-eight student drivers were recruited for the experiment. The two independent variables were training condition (experiment vs. control) and time (pre-and post-training driving performance). The dependent variable was the number of stops at amber traffic lights. At pre-training participants completed a computer game. This involved driving though 30 traffic light-controlled junctions, of which 20 changed to amber on approach. Participants had to decide whether to brake and stop at the junction (incurring a three second penalty) or to cross the junction and risk crashing (six second penalty). The training phase consisted of participants responding to coloured circles. Red, amber and purple circles required a 'left arrow' response (to mimic the left brake foot pedal) while green circles required a 'right arrow' response (accelerator foot pedal). Most trials (70%) showed green circles and 15% showed red circles. The remainder were Stop-Change trials. These initially showed a green circle which changed to amber after a random delay of 50ms, 150ms, or 300ms. Experimental participants were required to withhold their green response and instead make an amber response. For control participants these trials changed to a purple circle instead of amber. Participants then repeated the driving game.

Analysis: The effect of condition on stopping at amber traffic lights was investigated with a mixed 2 x 2 (time [pre-and post-training, repeated] x training condition [experimental vs. control, non- repeated]) ANOVA. Change in amber traffic light stopping was examined using independent t- tests on each condition.

Results: There was a significant interaction between time and condition: whilst both groups stopped at fewer amber traffic lights post-training compared to the pre-training driving game (an unexpected finding), the decline was only significant for the control condition. Those in the experimental group stopped at more amber lights post-training than controls consistent with hypotheses.

Conclusions: Stop-Change inhibition training offset the change in driving over time in a positive way leading to more cautious behaviour in the experimental participants than controls in a driving computer game. Although the conclusion is tentative due to the pilot nature of the work, the findings opens a new avenue of research in tackling dangerous driving though response inhibition training.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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20. Development and acceptability of an interactive voice response intervention to support medication adherence in patients with hypertension and/or type 2 diabetes within the primary care. A think aloud study

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The aim of this study was to pre-test the acceptability of an Interactive Voice Response (IVR) intervention to support patients with hypertension and/or type 2 diabetes, as an adjunct to primary care. The intervention contains Behaviour Change Techniques to promote medication adherence, and is based on the theoretical framework that distinguish between Intentional Non Adherence (INA) and Non Intentional Non Adherence (NINA). To our knowledge, this is the first study to develop and pre-test a theory and evidence-based IVR intervention outside of the US.

We developed and pre-tested the IVR in 13 patients with hypertension and/or type 2 diabetes, recruited from primary care databases and presumed to be non-adherent. Face-to-face interviews at patients' places were conducted, where each patient received IVR messages and asked to provide experiential feedback about the delivery mode and the intervention content. Think aloud protocol was used to assess intervention acceptability and thematic analysis informed the results.

Participants gave positive feedback on the IVR as a way to support medication adherence between their primary care consultations. Specifically, participants liked the navigation options, the voice delivering the messages and the voice recognition software. For intervention content, participants preferred messages that were tailored and personalised, and messages that consisted of information about health consequences, action plans and questions to report medication taking.

Patients recommended IVR as an acceptable platform to support adherence to medications between primary care consultations. Future studies could usefully test the feasibility of tailored IVR interventions to support medication adherence in the primary care.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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21. Validating a web-based intervention for teenagers with chronic illness and their parents

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Rationale: Chronic illness presents teenagers with significant stress that is associated with risk for emotional and behavioural problems, impacting on their ability to manage their condition and treatment. Furthermore, accounts of parents suggest they too feel unsupported in their role as manager of their child's illness. These insights demonstrate the need to develop interventions that provide additional support and target the particular needs of parents and teenagers in terms of promoting wellbeing and appropriate illness and treatment management. In a previous wave of co-creational research, with teens with Juvenile Idiopathic Arthritis (JIA) or Paediatric Plaque Psoriasis, their parents, as well as Rheumatology and Dermatology nurses, we were able to identify relevant support needs and solutions. The feedback was that a web- based intervention as part of a wider support programme is favoured by teenage patients and their parents. A functioning prototype of the website was designed and written based on the insights taken from the first wave of research. A user-testing approach is effective for validating a web-based programme from the user perspective.

Aims: To obtain feedback about the web-based intervention to inform final refinements to the programme, with specific focus on tone, style and relevance of the content and visuals, as well as ease of navigation and usability.

Methodology: Sixty participants from the UK and Italy, including teens (n=14) with Juvenile Idiopathic Arthritis (JIA) or Paediatric Plaque Psoriasis, their parents (n= 31), as well as Rheumatology and Dermatology nurses (n= 15) took part in web-assisted, semi-structured qualitative interviews using the Think Aloud technique to provide feedback about the stimuli. Analysis: The data were analysed by two researchers using a qualitative content analysis approach.

Results: The vast majority responded positively to the overall support programme and expressed interest in having access to the website. The website was considered by users to be an innovative 'one stop shop', user-friendly, visually attractive, and complete with relevant information.

Website tools and characteristics that were particularly well received or deemed innovative were a) interactive features such as checklists, trackers, and videos introducing real patients and parents, especially in the teenager group, b) tailored content and feedback, c) content, imagery, and features that conveyed a positive message, and d) less burdensome features such as concise articles and videos, particularly with teens. Additional features where patients and parents can communicate with similar others via live chat or forum, and maintain regular contact with an external health coach via phone calls or home visits were in high demand.

Conclusions: A web-based intervention that includes a variety of interactive and tailored features is desirable for teenagers with a chronic condition and their parents. Despite the benefits of and interest in digital interventions, maintaining a complementary human element, for example via health-coach or peer-to-peer contact, continues to be highly important to parents and patients.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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22. Virtual reality enhanced behaviour-change training for healthcare-associated infection prevention

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Rationale: Healthcare associated infections (HAI) continue to pose an important risk to patient safety, resulting in prolonged length of stay, increased microbial resistance, long-term disability and mortality, as well as excessive costs for health systems, patients and families. A significant portion of HAI may be prevented through the application of evidence-based practices such as hand hygiene and basic precautions during invasive procedures. The successful introduction of such practices relies to a great extent on interventions to change healthcare provider behaviour. Several challenges arise, however, when attempting to measure the impact of multifaceted behaviour-change interventions, such as the difficulty to control for the many variables in complex healthcare settings. Such difficulties preclude the use of traditional study designs, such as randomised controlled trials, to study the factors that influence healthcare provider behaviour in the real world. As an innovative solution, the introduction of virtual reality technology creates an ideal setting for studying behaviour in a controlled virtual environment. To take the lessons learned from such studies a step further, a virtual setting also creates the opportunity to apply behaviour change interventions (e.g. introduce behaviour-shaping feedback which is not feasible in the real world) therefor producing a training environment that may have lasting effects on real world behaviour.

Aims: We aim 1) to establish a virtual healthcare environment which will serve as a virtual lab to study the impact of controlled variables on healthcare provider behaviour while working in the virtual reality; and 2) to test the impact of training in a virtual environment on healthcare provider behaviour in the real world (transfer).

Methodology: A virtual reality environment has been programmed that simulates a University Hospital Zurich standard patient room with high fidelity. To study potential determinants of healthcare provider behaviour, we will employ randomised controlled trials to measure the effect of changes in the physical (e.g. handrub dispenser placement, visual cues) and social environment (e.g. presence of additional avatars, patient appearance) on infection prevention behaviours (e.g. hand disinfection, donning of personal protective equipment). To test the impact of virtual reality training on real-world behaviour, we will employ a controlled before- and-after study.

Analysis: Randomised controlled trials to study determinants of healthcare worker behaviour will be analysed using logistic regression. The before-and-after study to measure the effect of virtual reality training on real-world behaviour will be analysed using difference-in-differences tests.

Conclusions: We anticipate that virtual reality will offer a useful controlled environment for studying determinants of healthcare provider behaviour. The identification of behaviour shaping variables is a natural transition to designing behaviour change intervention. Studying virtual reality training in terms of transfer to real world behaviour is an important step towards validating the merit of this novel technology.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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23. Medical Aid Films

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Medical Aid Films is a unique organisation which brings together health and medical expertise with creative film makers in response to the global crisis in women's and child health. We use film and innovative media to transform the health and wellbeing of women and children around the world by building knowledge, skills and changing behaviours.

Our poster submission will demonstrate how film and animation has been used in both community and health centre settings to demonstrate the use of a new innovative life saving device (the CRADLE VSA) used to detect warning signs in pregnancy.

The CRADLE VSA was designed and engineered by King's College London utilising Bill and Melinda Gates funding. It is an innovative, robust and low cost device that measures heart rate and blood pressure, designed specifically to be used in low resource settings. It is very low cost at around $25 per unit, and very accurate for measuring both high and low blood pressure in pregnancy. Results are shown on a traffic light alert system so are accessible to every level of health care professional as well as patients themselves. The capacity of the device to save lives is currently being tested at 293 facilities across 10 sites in 8 different countries including Zimbabwe, Zambia, Uganda and Ethiopia.

In partnership with the team at King's College we developed and produced training films to enable health workers and communities to use this life saving tool. Two versions of the film were made, one for skilled health workers and one for community health workers. Both films are available to stream and download for free online via our website (www.medicalaidfilms.org). The films are available in English, Haitian Creole and Kannada.

The film script was reviewed at each stage by stake holders including implementation experts, end-user representatives and product manufacturers. Animation was chosen in order to make the film appropriate in a wide variety of contexts and allow easy translation of voice over. The understanding of the film was assessed using questionnaires and results were used to inform changes.

We will provide a couple of the devices for the audience to interact with. Team members will be on hand to help with the demonstrations, talk through the poster/project, and answer any questions the audience may have.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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24. Using computer, mobile and wearable technology interventions to change sedentary behaviours: a systematic review and meta-analysis

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Rationale: High levels of sedentary behavior (SB) are strongly associated with several negative health consequences (1). Technologies such as mobile applications (apps), wearable activity monitors, prompting software, texts, emails and websites are being harnessed to reduce SB. Systematic reviews have not explored the effectiveness of computer, mobile and wearable technology to reduce SB and there is little information regarding the behavior change techniques (BCTs) they contain.

Aims: The aim of this systematic review and meta-analysis is to critically evaluate the effectiveness of computer based, mobile and wearable technology interventions targeting SB reduction in healthy adults and to examine the BCTs used.

Methodology: Electronic databases (PubMed; MEDLINE; EMBASE; CINAHL; PsycINFO) were searched using predefined search strategies to identify randomised-controlled trials (RCTs) published up to June 2016. Included studies required a control or active comparator group and a pre-post measure of SB. Studies were screened for inclusion and data were extracted. Risk of

bias was assessed using the Cochrane Collaboration's tool for assessing risk of bias in randomised trials (2). Interventions were coded using the BCT taxonomy (v1) (3).

Analysis: Where more than one measure of SB was available, objective data was given priority over subjective data. Mean differences and standard deviation (SD) of sedentary time, (min/d) was extracted from SB interventions and controls to permit a random effects meta-analysis. Sensitivity analysis was not possible.

Results: 32048 papers (17676 after duplicate removal) were identified from which 17 were included. A variety of computer, mobile and wearable technologies were including, websites (n=7), software prompts (n=6), emails, (n=6), activity monitors (n=3), e-coaching (n=1) and mobile apps (n=1). Ten studies focused on work place sitting, while seven targeted overall daily SB. Meta-analysis of 15 studies suggested that computer, mobile and wearable technology interventions effectively reduced sitting time by 41.28 min/day (95% CI -60.99, -21.58, n=1402) at end point follow up in favour of the intervention group. Work place interventions reduced SB by 39.88 min/work day (95% CI -59.58, -20.18, 8 studies, n=762) participants and overall daily interventions reduced SB by 45.11 mins/day (95% CI -86.63, -3.60, 7 studies, n=640) favouring the intervention group. Intervention duration ranged from a once off interaction to 24 months. 14 studies were at high risk of bias, two at unclear risk and one low risk of bias. The interventions reported the use of 25 different BCTs (four to 15 per study). 16 studies used behavior substitution. Prompts and cues, and habit reversal, were both utilised in 13 studies.

Conclusion: A range of behaviour change techniques were used including behaviour substitution, prompts and cues, and habit reversal. Although computer based, mobile and wearable technology appear to be promising approaches to reduce SB, this finding should be interpreted with caution as the majority of studies were at a high risk of bias.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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25. Using social media (particularly Facebook) for preventative tobacco control amongst teenagers in Botswana by building resilience and stripping the aspiration out of smoking.

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Tobacco use rates amongst young people have been rising rapidly in many countries across Africa. The problem is particularly acute for young women, who traditionally do not use tobacco. Teen girl tobacco use significantly exceeds adult women tobacco use in multiple markets, including Botswana, suggesting an epidemic in the making.

Good Business has developed and launched a social media led tobacco prevention programme in Botswana based around a new teen brand called SKY. The programme uses social marketing to create health related behaviour change.

SKY is a girl led movement which is all about girls 'being true' to themselves, and expressing themselves through the choices they make about things, including a choice about tobacco. The programme is funded by the Bill & Melinda Gates Foundation.

The SKY Facebook page is the central hub of the community, it is where the girls express what they like 'sure ka yone' and what they don't like 'shapo ka yone,' share their views about things, and support each other. It is also where a lot of discussion around tobacco takes place, and girls commit to saying 'shapo' to tobacco.

All other programme activity and content - from the magazine we publish to the radio show teen girls host - is also added to the Facebook page where it is shared between and discussed by girls. This significantly amplifies the impact of this other activity, and therefore its cost effectiveness.

The SKY facebook page is in the top 10 most 'liked' Facebook pages in the country.

Other social media, including Twitter and Instagram, form a supporting role in the movement, and we also use WhatsApp chat groups to build smaller networks within the SKY community to help build and develop the movement and to embed our tobacco free message. We have also recently launched a vlog which acts as a great vehicle for our tobacco related messaging.

Initial results suggest that we are effectively using social media as part of our broader programme to stop girls from taking up smoking. We achieved the targets set against the majority of our key performance indicators around tobacco related attitudes, perceptions and behaviours in the endline study conducted by the University of Botswana at the end of our first grant period, and have been awarded a second grant from the Foundation to continue the programme.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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26. NoHoW Project: Evidence-based digital tools for weight loss maintenance

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Rationale: Very few comprehensive treatments are currently available for weight loss maintenance (WLM). Research suggests that if interventions are to be effective in promoting sustained health behaviour change they should use theory- and evidence-based techniques. Digital solutions have the potential to provide accessible, scalable channels for people to engage with these evidence-based behaviour change techniques. The NoHoW project is a European Union H2020-funded project bringing together leading experts in behaviour change, technology providers, and weight loss/ obesity to develop tools to help people maintain previously lost weight.

Aim: NoHoW will carry out a large-scale European randomized controlled trial to test whether different evidence-based and novel behaviour change, emotion- and self-regulation techniques delivered via a digital toolkit, promote successful WLM.

Methods: The NoHoW trial is a 3-centre (Denmark, Portugal, United Kingdom) 2x2 randomized controlled trial (RCT) targeting approximately 1600 participants that lost at least 5% of their weight in the last 12 months. Primary outcomes are weight, body composition, cortisol, full lipids & HbA1c; and secondary outcomes are diet, physical activity, sleep, moderators and mediators of behaviour change, predictors of relapse/maintenance, process evaluation and cost- effectiveness. The NoHoW trial tests behavior change approaches for self-regulation and motivation versus emotion regulation/stress management for WLM. These approaches are delivered through a digital toolkit. The toolkit includes a set of web-app tools and inputs from other technologies, such as smart scales and activity trackers, and offers a personalised behaviour modification feedback system targeting weight, sleep, physical activity, and dietary behaviours. Informed by the guidelines for the development of complex

behaviour change interventions and principles applied in previous theory-based behaviour change interventions, we used a systematic approach to the translation of theory and evidence to intervention components.

Expected results and impact: The RCT and linked studies of European consumer needs and behaviour will test whether digitally-based delivery of evidence-based behaviour change techniques is effective for WLM. Project results will feed into new developments for implementation by Slimming World (a large European commercial weight-loss provider), providing WLM benefits to >700,000 overweight and obese individuals. Large-scale implementation of online WLM tools will provide complementary, enhanced support to services that promote health education and weight management.

Conclusion: A systematic approach to the development of digital solutions based on theory, evidence, and user-testing, can largely contribute to the advancement of the science of behavior change and implementation of sustainable solutions to WLM across the Europe.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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27. The role of mobile text and voice communication in the monitoring of chronic disease management within resource-poor low- and middle-income country public primary healthcare settings: a realist review

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Background: Mobile health for chronic disease management is being investigated as a potential solution to improve patient outcomes in low-resource settings, where mobile phones are becoming commonplace. This review adopts a realist approach and addresses the role of mobile text and voice communication in the monitoring of chronic disease management within resource poor low- and middle-income primary healthcare settings in public health systems. Chronic disease involves regular self-care (Shippee et al., 2012; Kadirvelu et al., 2012) and routine monitoring by patients and healthcare-providers to check disease progress or regress. Mobile health (mHealth) has been proposed as one way to improve management of chronic diseases (Stephani et al., 2016; Piette et al., 2016; Beratarrechea et al., 2017)

Method: To map the evidence for the effectiveness of mHealth communication (text-based and voice) for the management of chronic diseases in LMIC, by considering the context and design considerations of effective interventions, we conducted a systematic search for relevant systematic reviews. We summarised: a) the evidence for effect of mHealth technology; b) the type of intervention; c) evidence gaps identified by review authors and; d) the mechanisms by which the interventions were thought to work (Anstey-Watkins, 2016) from 23 reviews. From this we discussed the programme theory about how the review authors thought the interventions in the review studies intended to work in relation to monitoring of chronic diseases A realist synthesis was then conducted to investigate whether mHealth text and voice interventions for the monitoring of chronic diseases in public primary care in LMICs are likely to achieve health benefits. We systematically searched for empirical studies published from 2000-2016 on monitoring of chronic disease using text or voice interventions in LMICs settings. We aimed to tackle the lack of theoretical understanding of why mHealth interventions work or not for a particular population. Evidence was appraised, data extracted and synthesised and a refined programme theory is illustrated in a theoretical framework developed using established high-level theory and context, mechanism and outcome configurations (CMOc). The next stage was to search for theory relevant to how the study interventions worked in practice. We identified two conceptual frameworks

relevant to our interventions. Michie et al. (2013:7) framework includes the domains of Capabilities (C), Opportunities (O) and Motivations (M) necessary for Behaviour (B). Each domain leading to Behaviour has subdomains: Capability - physical skills, knowledge, behavioural regulation and memory, attention and decision processes; Opportunity - environmental context, resources and social influences; Motivation - beliefs about consequences, optimism and beliefs about capabilities and reinforcement and emotion. We found these applied to every intervention mechanism as demonstrated in Figure 3, the final theoretical framework. The framework developed by Vassilev et al. (2015:23) in a tele-monitoring review contains three concepts: Relationships - providing support for behavioural change, feedback and reinforcement; Fit - how to integrate mHealth into routine and ease of use - and; Visibility - to engage in information to mediate and motivate self-management tasks. We categorised the mechanisms of action of the interventions into the concepts of relationship, visibility and fit.

Results: Data was extracted from 11 empirical studies. The types of monitoring interventions of the interventions was as follows:involved information exchange, behavioural change using a buddy system, automated messaging and supportive counselling services to assist and improve monitoring. The types of mechanisms necessary are support line, observation, reinforcement and feedback, reminders, education and advice, decision-support, motivation, health promotion and information. A level of agency-dependent behavioural domains (capability, opportunity and motivation) are necessary for effective monitoring. This is given the relationship, fit and visibility of the intervention and two or more of the nine identified mechanisms are present to trigger the desired outcomes in a particular context. Overall, the findings suggest that that combinations of mechanisms are desirable for the target outcome to result. Most of the empirical studies targeted two or more mechanisms. If there are several mechanisms used in the design of the intervention, this may enable a reaction or response by the patient to make a desired change. If more than one mechanism is presented, then there is a greater chance that the patient's reasoning will react to the available resources. A theoretical framework has been developed from the CMOc from each study and can be applied to future designs of mHealth monitoring interventions. Findings add to the knowledge of mHealth monitoring by suggesting useful reasoning and resource mechanisms to incorporate into intervention design.

Conclusion: This is the first realist review on monitoring of chronic disease using mHealth for low-resource settings. Even though effectiveness evidence is weak, the use of text or voice interventions to assist with patient management is evolving, as is the literature. It is not clear whether the mHealth interventions are effective over long durations with sustained effects, or for chronic diseases that were not included in the empirical studies, such as mental health conditions or asthma, and, lastly, whether the desired outcome will result if a patient has comorbidity. Future empirical studies would benefit from using the proposed theoretical framework and the effective design considerations from the review of reviews. We argue that the type and combination of mechanisms (supported by theory) can be considered in the design of mHealth interventions. This review contributes to what is known about contexts in which the effect of mobile monitoring can occur and the possible mechanisms through which chronic disease management using mobile monitoring are able to achieve target outcomes and improve health status.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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28. Physical Activity Tailored intervention in Hospital Staff (PATHS): a randomised controlled trial of computer-tailored program

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Background: Most people do not engage in sufficient physical activity to confer health benefits and to reduce risk of chronic diseases. Healthcare professionals frequently provide guidance on physical activity; however often they do not meet the recommendations themselves. The main objective of this study was to develop and test the efficacy of tailored intervention in healthcare professionals to increase their physical activity and quality of life, and to reduce work-related stress and absenteeism. This is the first study to compare the additive effects of three forms of a tailored intervention using different techniques from behavioural theory, which differ according to their focus on motivational, self-regulatory and/or habitual processes.

Methods/Design: Healthcare professionals (N = 142) were recruited from hospitals in Perth, Western Australia, via mailing lists, leaflets, and posters to participate in the four group randomised controlled trial. Participants were randomised to one of four conditions:

1. education only (non-tailored information only, control),
2. education plus intervention components to enhance motivation,
3. education plus components to enhance motivation and self-regulation,
4. education plus components to enhance motivation, self-regulation and habit formation.

All intervention groups received a computer-tailored intervention administered via a web-based platform and supporting text-messages containing tailored information, prompts and feedback relevant to each condition. All outcomes were assessed at baseline, and at 3-month follow-up.

The primary outcome assessed in this study was physical activity measured using activity monitors. Secondary outcomes included: quality of life, stress, anxiety, sleep, and absenteeism. Website engagement, retention, preferences and intervention fidelity were evaluated as well as potential mediators and moderators of intervention effect. This rapid response poster will include study protocol and preliminary results of the intervention.

Discussion: This is the first study to examine a tailored, technology-supported intervention aiming to increase physical activity in healthcare professionals. The inclusion of different behavioural change techniques founded in different theories assessed the effectiveness of motivational, self-regulatory and habit-forming strategies in promoting physical activity. The online platform developed in this study has potential to deliver efficient, scalable and personally-relevant intervention that can be translated to other occupational settings.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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29. The Design and Usability Testing of a mHealth Application for Supporting Self-Regulation of Exercising Older Adults

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Rationale: Physical activity is vital to a healthy life. Not only can it lower the risk of various diseases, but older adults can also delay the onset of functional impairments. This allows older adults to live for a longer time independently and increases the quality of life. For this reason community based programs like the Dutch 'Exercise for Seniors' offer weekly classes that allow older adults to exercise in groups under guidance of an instructor. However, exercising once a week is not sufficient to attain health benefits. To achieve the recommended intensity a home-based exercise program could prove an useful addition to a community based program: in the convenience of their home older adults can continue the exercises they have learnt during the weekly community classes. A previous focus- group study showed that the MBvO-participants believed additional home exercises would be useful, but also had worries about the safety, self-efficacy and adherence to such an intervention. The authors conceived a blended approach would increase the chances of success.

Aims: The aim of this study was to determine the usability of an app that was designed to support older adults in doing exercises safely and persistently at home.

Methodology: An app for a tablet was developed to support the self-regulation by implementing goal setting, action planning, graded tasks, prompts, remote- and self-monitoring and feedback amongst other behavior change techniques. It featured for instance 48 instructional videos that demonstrated exercises that were designed by human movement scientists. With a wizard a tailored exercise program could be drawn up in line with personal goals. Furthermore, users could track the progress and evaluate exercises. This could be remotely monitored by a coach with whom users can video call for guidance. To ascertain the app was sufficiently user-friendly 15 older adults, ranging from 69 to 99 years old, were asked to perform 11 tasks in a usability lab. The participants were instructed to think aloud and after completing the tasks they were interviewed briefly about their general impressions.

Analysis: The task-completion time and type of errors were determined on basis of recordings. Furthermore, the comments made during the task (think-aloud protocol) and exit interviewed were valuated. All analysis were done independently by two researchers to increase the objectivity.

Results and conclusions: The results from the usability study indicate that the app appears to be sufficient user-friendly. The vast majority of the users could complete the assigned tasks within reasonable limits: on average within a minute, with occasionally one or two hints. The authors found this to be satisfactory. The majority of the users, ranging from 69 to 99 years old, had no prior experience with tablets. It can be presumed that their ability to operate the app will increase with time. Furthermore, being able to get support from a coach is part of the envisioned blended intervention. Planned follow up studies will determine the long-term user experience and if the intervention leads to measurable health benefits by supporting the self-regulation of older adults.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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30. The efficacy and dose-response effects of CBM as a digital intervention for individuals with high levels of depressive symptom

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Rationale: Negative bias in facial emotion perception, the tendency to perceive facial emotions expressions negatively (e.g., sad), is a common feature in a range of mental health disorders (e.g., depression). It has been proposed to be on the causal pathway of the development of such disorders and a possible target for intervention. The current study is of a novel cognitive bias modification (CBM) technique that targets biases in emotion processing.

Aims: To investigate the dose-response effects of CBM as a digital intervention for individuals with high levels of depressive symptom.

Methodology: This is a pre-registered randomised control trial conducted on 190 adults with high levels of depressive symptoms (those scoring ≥14 on the Beck Depression Inventory-II) from the general population. After screening, participants were randomised to intervention or control procedures, repeated five times over consecutive days, with a follow up at the end of treatment, 2 weeks and 6 weeks after training. Participants viewed images of faces that were morphed between different intensities of sadness and happiness, and indicated whether they perceived the emotion as 'happy' or 'sad'. They received feedback on their response. In the intervention condition, feedback was adjusted to 'happy' for the two images below the 'bias point' (which indicates when participants start perceiving happy over sad faces). In the placebo condition, the feedback was not biased but based on participants' bias point.

Analysis: Repeated measures analysis of variance (ANOVA) and t-tests were conducted on the bias point and number of happy faces perceived. These unregistered analyses were performed on the data from the intervention group only.

Results: Participants in the intervention group showed a bias towards happy over sad faces after training; there was an increase of an average of 3.5 bias points after training ($p<.001$, $\eta2p=.69$), whereas sham training participants showed no change in bias. This positive bias remained higher than pre-training 2 weeks later ($p<.001$, $\eta2p=.32$) despite a reduction from post-training (by mean$=.71$ bias point; $p<.001$, $\eta2p=.18$). There was an average increase of 6 out of 30 faces perceived as happy at the end of the training ($p<.001$, $\eta2p=.72$). Increase in the number of happy faces was most pronounced between the first two sessions ($p=.033$), but also evident after session 2 ($p=.053$).

Conclusions: This research shows that brief sessions of bias modification may be as effective and more acceptable to potential users than longer sessions, typical of laboratory studies.

Conflict of Interest: MM and IP-V are co-directors of Jericoe Ltd, which produces software for the assessment and modification of emotion perception.

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31. Combining the intervention mapping and behavioral intervention technology frameworks: pilot study results of an adaptive smartphone delivered intervention for physical activity and sedentary behaviour change

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Rationale: Modifying the proportion of daily time spent being physically active and sedentary is important to achieve positive health outcomes. Many physical activity promotion interventions require substantial human interaction, and automated systems that can assess behavioural data and provide the required interventions are lacking. There is a need for novel approaches to engage those who are insufficiently active and sedentary to encourage good health. Moreover, physical activity (PA) and sedentary behaviour (SB) interventions that adapt dynamically to changes in the individual's behaviour over time may be more effective than static ones.

Aims: To investigate the feasibility and effects of an evidence-based adaptive smartphone-delivered intervention that 1) captured movement behaviour in the context where it occurs using inbuilt smartphone sensors and 2) delivers behaviour change content, such as automated daily goal setting and feedback, to support PA and interruptions in sedentary time.

Methodology: The Intervention Mapping and Behavioural Intervention Technology frameworks were used in combination to develop the intervention. The Integrated Behaviour Change Model was used to guide the selection of constructs/determinants of PA that the intervention aimed to influence. A single group 8-week prospective study with pre- and post-intervention assessments was conducted in Auckland, New Zealand. Acceptability (e.g. "The app gave me positively phrased alerts") was assessed using 10 items developed from previous qualitative research identifying desired app features. Perceived usefulness of behaviour change techniques – BCTs (e.g. "It was important for me that the app prompted me to plan how/where/when to be active") was assessed using 23 items based on previous research evaluating adults' ratings of BCTs among apps aiming to promote PA. Secondary outcomes included the effects on objectively measured (i.e. daily time spent in different intensities of PA and SB) and self- reported PA and SB outcomes (i.e. individual and interpersonal determinants of PA from the Integrated Behaviour Change Model).

Analysis: Descriptive statistics were used to describe usage and the percentage of answers to each category of the items regarding usability and acceptability of the smartphone app. Intention-to-treat analysis was performed using Paired-samples t-tests and Wilcoxon signed-rank tests (where warranted) for the self-reported PA determinants. Random-effects mixed models were used on daily repeated measurement of PA and SB outcomes collected objectively via the smartphone inbuilt sensors. Statistical analyses of the smartphone-generated data were undertaken using SAS software (SAS Institute, Cary, NC, USA). All statistical tests were 2-sided at a 5% significance level.

Results: Preliminary results indicated 69 participants used the application; most were female (78%) with a mean age of 34.5 years (SD = 11.8) and a BMI of 25.6 kg/m2 (SD 4.95). Most were NZ European (55%, n=38/69) and Indian (n=16%, n=11/69). During the 56-days intervention period, the app was opened each day by an average of 13.6 participants (SD=10.5, median=9, min=4, max=69 on the first day of the intervention). 54.3% of participants agreed the app was low effort and pleasant to use (18.7% disagreed). 52.6% agreed it provided guidance on how to change the activity profile (18.7% disagreed) and that it gave positively framed messages (64.4% agreed, 5.1% disagreed). A large proportion (42.3%) disagreed that the app sustained interest over the eight weeks. 30.5% reported the app negatively impacted /restricted other uses of their device, such as draining the battery. BCTs employed in the app such as feedback on behaviour (72.8%) and behaviour substitution (71.1%) were rated more favourably for perceived usefulness. Other BCTs, such as social support (e.g. give information about local groups that offer support to be active), information about social and environmental consequences (e.g. present the decrease of CO_2 emissions if biking/walking/taking public transport to commute), credible source (e.g. show videos of doctors emphasising the importance of being active) were rated frequently (i.e. > 20%) as not applicable, indicating participants were less likely exposed to, or used such BCTs. On average, participants increased time spent on total PA, moderate-to-vigorous-intensity-PA and light-intensity-PA (LPA) post-intervention, but only LPA was significantly different from baseline (LPA adjusted mean difference 2.17 min, 95% CI 0.78 to 3.56, P=.002).

Conclusions: This pilot study demonstrated the feasibility and acceptability of the app intervention to modify individuals' PA/SB behaviours, but given the small sample size and design limitations, effects were modest. Proof-of-concept of using smartphone technology to capture movement data and inform intervention delivery was demonstrated. Future iterations should address the identified shortcomings, optimise, and test the effectiveness of the intervention in a larger sample.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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