Mapping out technological designs employed in digital interventions to reduce sedentary behaviours

By Yitong Huang & Holly Blake – University of Nottingham

Prolonged sedentary time is adversely and independently associated with health outcomes and risk of mortality, and as such is a rising public health concern. Many office-based occupations contribute to increased risk of prolonged sedentary behaviour. Digital technologies, such as computer software, web apps, wearables, and Internet of Things, with activity monitoring and feedback functionalities, are increasingly being deployed in the workplace, with the purpose to motivate sitting reduction and regular breaks. The past decades have seen an exponential growth of computing power at affordable prices. This has resulted in an increasing variety of digital gadgets (e.g. personal computer, tablets, smartphones, wearables, and Internet of Things) that a person is exposed to and interacts with on a day-to-day basis. Such a range of technology provides health intervention designers with a wider range of device choices that offer different form factors and features. However, it is still unclear **what devices and digital features are suitable to be included in sedentary behaviour intervention targeting office workers?**

Our recent study, "Digital Interventions to Reduce Sedentary Behaviours of Office Workers: Scoping Review", could be particularly informative to those looking to locate the relevant design inputs.

Compared with previous reviews on sedentary behaviour interventions, our study has a focus on the technological design and includes evidence from the engineering and computer science arena as well as public health. We set out to achieve two aims. First, to map out the technological landscape and research activities conducted in different disciplines on this topic; and second, to determine research gaps in terms of utilizing and innovating technologies for workplace sedentary behaviour interventions.

A total of 68 articles describing 45 digital interventions were included in the study. We categorized the articles and interventions into development, feasibility/piloting, evaluation, and implementation phases based on the UK Medical Research Council (MRC) framework for developing and evaluating complex interventions; we also developed a novel framework to classify technological features and annotate technological configurations. The framework encompasses common technological features such information delivery, digital logs, passive data collection, automated tailored feedback, scheduled prompts, connected devices, and mediated organizational support and social influences.

Our study identified a research gap in the integration of passive data collection and connected devices with automated tailored feedback or scheduled prompts, as most of the published studies employing such configurations were still in the development or feasibility/piloting phase. For instance, validated passive data collection devices like the ActivPAL (PAL Technologies Ltd, Glasgow, United Kingdom) and ActiGraph (LLC, Pensacola, FL, USA) were widely used for outcome measurement in interventional studies, but less commonly used for intervention delivery. One explanation is that early models of the ActivPAL and ActiGraph devices were not equipped with any output module (e.g. a screen) to let wearers, or even researchers, receive feedback on sedentary behaviour during

the monitoring period. Their stored data is also not accessible to third-party apps or devices in real-time for implementation of Just-In Time Adaptive Interventions (JITAI). This may, in turn, demotivate deployment of those devices beyond the assessment period (usually 1 week or 5 workdays). However, collection of data continuously throughout the whole study period can generate valuable insights into the process of change, as demonstrated in several studies. Hence, our findings highlight the importance of interdisciplinary and intersectoral collaborations to maximize the potential of technologies. For instance, the provision of Application Programming Interfaces (APIs) by manufactures to allow research-purposed apps or devices to stream the devices' raw data in real-time or near real-time will accelerate development and innovation in this field.

Our findings also uncovered a lack of research on scheduled prompts beyond the feasibility/piloting phase. We suggest that research opportunities exist in exploiting novel digital interfaces with wireless connectivity for promoting and persuading office workers. Exciting development and pilot studies on tangible, embedded and ambientmedia are being conducted in engineering, computing, and design fields. However, innovations in these fields do not seem to effectively move to the next phase of evaluation with more rigorous study designs (more commonplace in public health and the behavioural sciences). It requires more thinking as to what kind of mechanisms can be helpful for feeding design-related findings into other fields with an interest in behavioural change, and for moving the novel technologies downstream to the evaluation and implementation phase. As a starting point, we suggest researchers from all disciplines familiarize themselves with the MRC framework, report and position their research in the big picture of developing and evaluating complex interventions.

You can read the full paper here.

Questions:

1. What is the potential of novel digital media (e.g. wearables, Internet of Things, programmable physical artefacts) for delivering behaviour change intervention? Is it worth the efforts to moving them downstream to the evaluation and implementation phase?

2. How can we better connect and empower two communities—[a] those with expertise in health behaviour change, intervention content development, and evaluation, and [b] those with enhanced technical capacity to design and develop technologies, and study end-user interactions with technologies?

3. How does your field consider, practise and disseminate "design and development" research?

Bio:

 Yitong Huang @EchoYitongHuang previously graduated from UCL with an MSc in Social Cognition and is now a PhD student at the Horizon Centre for Doctoral Training, University of Nottingham. Her PhD is looking at the opportunities and challenges with using Internet of Things to encourage healthier office work behaviours. The project is co-funded by the EPSRC and Unilever UK. Yitong's broader research interests include persuasive designs for various behaviour change contexts and designs that bring about positive changes in people's lives. She has an interdisciplinary approach to research and innovation, by drawing on a combination of theory- and evidence-based intervention design frameworks and user-centred system design methods.

Dr Holly Blake @hollyblakenotts is Associate Professor of Behavioural Science at the University of Nottingham Faculty of Medicine and Health Sciences, and a member of the Centre for Healthcare Technologies (CHT). She is a Chartered Health Psychologist, Associate Fellow of the British Psychological Society (AFBPsS), and Senior Fellow of the Higher Education Academy (SFHEA). Her work has contributed to the development of health and wellbeing services for employees in the public, private and third sector, in the UK, Europe, Middle East, and Asia. More broadly, Holly has research interests in workforce issues, health services research, patient experiences and self-management strategies in people living with long-term conditions. Including the application of technology to improving healthcare, education, self-care practices and the patient experience.