

## Current Issues and Future Directions for Research Into Digital Behavior Change Interventions

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This series of five papers plus an accompanying commentary provides a “state-of-the-art” overview of some of the most pressing issues in the field of research into digital behavior change interventions (DBCIs), highlighting the need and potential for conceptual and methodologic advances. The papers are the product of a process of international expert consensus building, supported by the United Kingdom’s Medical Research Council, the U.S. NIH’s Office for Behavioral and Social Sciences Research, and the Robert Wood Johnson Foundation. The papers are aimed at a broad readership, including those who develop, evaluate, use, and fund DBCIs for both research and practical purposes. The aim is to provide guidance as to:

1. how more effective and cost-effective DBCIs can be developed, how they should be assessed, and the scientific priorities that must be addressed to advance research in this field;
2. how DBCIs can be used to advance scientific understanding of human behavior and behavior change.

By way of background, in early 2014, an international and multidisciplinary steering committee, led by Professor Susan Michie and Professor Jeremy Wyatt, identified important topics for consideration and then participants who were either current or emerging leaders in their respective domains to address these topics. This led to a wide consultation process, involving an international group of experts in key aspects of DCBI development, evaluation, and usage, drawn from the disciplines of behavioral and social science, medicine, public health, health services research, computer science and engineering, and economics. Participants were invited to join writing groups relating to each topic and to attend a 2-day workshop held in London in September 2015. The writing groups produced an initial draft of each paper for presentation for in-depth discussion at the workshop, and then revised the papers, informed by the discussions of the 42 experts who attended the workshop. The second paper in the series<sup>1</sup> was also informed by a preceding 2-day international workshop focused specifically on the use of modeling in DBCIs.

In this series of papers, the term “DBCi” is used to refer to an intervention that employs digital technology to promote and maintain health, through primary or secondary prevention and management of health problems. The technologies used can include not only the Internet (accessed by smartphone, PC, or tablet) but also automated healthcare and communication systems and an increasing array of mobile, wearable, and environmental sensors as well as emerging Internet of Things devices that can provide intelligent monitoring and feedback as and when needed (“Just-In-Time Adaptive Interventions” or “Ecological Momentary Interventions”). DBCi are typically automated, interactive, and personalized, employing user input or sensor data to tailor feedback or treatment pathways without the need for health professional input, although they may also involve elements of tele-health care (digitally mediated remote monitoring by health professionals) or direct interactions with human facilitators. DBCi can be used to promote health by supporting behavior change or decision making (whether of the general public, patients, or healthcare practitioners), improving communication, facilitating efficient and effective treatment, or enhancing physical and mental well-being.

The first of the five main papers<sup>2</sup> provides a broad-ranging reflection on how advances in technology, new findings about the determinants of health and illness, and changing modes of health care set the stage for new methods of behavior change research and practice. This paper lays the groundwork for the second paper<sup>1</sup>, which focuses on how DBCi provide both an opportunity and a need to develop and test adaptive behavioral models and theories with the potential to define precisely when and how a variety of intervention techniques might be used in DBCi. The third paper<sup>3</sup> considers how DBCi can be evaluated efficiently and appropriately and argues that a combination of biomedical, behavioral, computing, and engineering research methods is required to address a range of research questions, including the likely reach, uptake, mechanisms, cost effectiveness, and harms of the intervention.

The fourth paper<sup>4</sup> addresses issues relevant to conceptualizing, understanding, and promoting engagement with DBCi, highlighting the need to develop and validate complementary, non-intrusive assessment methods to fully capture the multidimensional, dynamic process of “effective engagement.” The fifth paper<sup>5</sup> notes that economic evaluations of DBCi must develop methods of modeling the complex interactions between intervention users and their environment, which can have important implications for the wider impact of the intervention. Finally, the commentary by Professor Kelly<sup>6</sup> addresses some of the social, environmental, ethical, and philosophical issues raised by these new tools and technologies. The predominant focus of these papers is on the use of DBCi for individual-level interventions that promote improved health behaviors. However, given the potential to scale these technologies, applications, and services to ever-larger numbers of users, the potential for population and public health impact is great. Professor Kelly<sup>6</sup> (who attended the London workshop) has provided an insightful commentary on this issue.

Given the dynamic nature of this field, it will be necessary to revisit the themes and topics addressed in these papers on a frequent and regular basis as experience of developing, evaluating, and implementing DBCi increases. The authors welcome feedback from readers about the methods by which this might be done.

## References

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