Exploring the Contributions of N-of-1 Methods to Health Psychology Research and Practice

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N-of-1 methods involve the repeated measurement of an individual (or individual unit) over time to draw conclusions about the individual being measured. N-of-1 methods offer a number of opportunities for answering some of the important questions in health psychology. For example, they can be used to describe the natural course of behaviour over time, test theories of behaviour, evaluate individual intervention response and inform the design of personalised behaviour change interventions (McDonald et al., 2017a). The UK Medical Research Council (MRC) recommends the use of n-of-1 methods for testing theory and evaluating complex interventions (Medical Research Council, 2008).

In October 2017, we organised a one-day seminar on the topic of n-of-1 methods applied to health psychology, funded by the Division of Health Psychology (DHP). It attracted people of varying experience and backgrounds with an interest in examining psychological processes at the individual level and personalised behaviour change. The goal of the seminar was to learn and share experiences of conducting n-of-1 studies, consider key challenges, opportunities and practical issues, and discuss broader priorities for n-of-1 methods in health psychology research and practice.

The seminar featured three presentations and two group discussions. The first presentation was delivered by Dr Suzanne McDonald, who described the 'state of the art' of n-of-1 methods in health psychology. Drawing on the findings from a recent systematic review, she showed that only a small number of high quality n-of-1 studies have been published in health psychology since the MRC recommendations were published ten years ago (McDonald et al., 2017a). Observational and rigorous interventional n-of-1 designs have been absent from the literature and there is scope to apply n-of-1 methods to a broader range of health behaviours and outcomes. Nevertheless, interest is growing; recently there has been several significant general methodological developments and an increased presence at conferences (McDonald & Davidson, 2016; Tate et al., 2016). N-of-1 methods

have an important role in an era of precision medicine, shared-decision-making and patient-centred healthcare.

In the second presentation, Professor Derek Johnston focused on statistical methods for analysing n-of-1 data. The presentation cautioned against relying solely on visual inspection of n-of-1 data. Gathering enough data to conduct statistical analysis was strongly recommended and three important statistical issues were described – sample size, systematic trends in the data and autocorrelation (i.e. serial dependence between repeated measurements). Some statistical methods were reviewed including 'pre-whitening' methods (Naughton & Johnston, 2014), dynamic regression modelling (Vieira, McDonald, Araujo-Soares, Sniehotta, & Henderson, 2017), Auto-Regressive Integrated Moving Average (ARIMA) modelling (Box & Jenkins, 1970) and the 2-stage double bootstrap procedure (McKnight, McKean, & Huitema, 2000).

Dr Peter Tennant discussed the developing field of causal statistics in the last presentation. The presentation addressed the importance of taking a causal inference perspective when analysing observational n-of-1 data. Lessons from causal inference methods are particularly relevant for health psychology, where there has been a tendency to focus on prediction, when the real interest is in understanding causality (Rohrer, 2018). It is important to understand the cause of behaviour if one wants to change it, but this involves careful thought about how the measured variables fit together in a causal framework. These frameworks should be used to inform our statistical models when analysing n-of-1 observational data in order to enrich our understanding of causality.

The first group discussion, facilitated by Dr Felix Naughton and Professor Falko Sniehotta, covered measurement issues that are specific and critical to n-of-1 studies. These included participant burden, adherence, methods of measurement and the use of single-items. The discussion highlighted the flexible nature of n-of-1 methods. For example, many aspects of the design can be tailored to the preferences or circumstances of the participant (Hobbs, Dixon, Johnston, & Howie, 2013; McDonald et al., 2017b). This type of personalisation may promote participant engagement and enrich data interpretation.

The last group discussion focused on the future for n-of-1 methods in health psychology. Dr Diane Dixon shared her thoughts and reflections and inspired attendees to think about the important ways n-of-1 methods can contribute to a broad understanding of human behaviour in psychology. The group discussed key issues such as why n-of-1 methods

have been under-used and under-recognised in health psychology, how they could be promoted to others, how they could be developed so that they are useful in practice and priorities for future n-of-1 research. The discussion identified some important activities moving forward such as exploring perceived barriers, increasing awareness and providing education and training.

The seminar led to several outcomes that will facilitate the development and utility of n-of-1 methods in health psychology research and practice. Some of these outcomes will be discussed during an n-of-1 symposium at the DHP Annual conference in 2018. We have established a UK-based network for n-of-1 methods (https://uknof1methods.wordpress.com), which will provide a platform for individuals to learn about these methods, share experiences and collaborate on future n-of-1 research activities.

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