The Future of Beh"AI"viour Change

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Health behaviour change represents what is potentially the most effective, sustainable, and feasible means of preventing some of the most serious causes of death globally – including ischaemic heart disease, stroke, and chronic obstructive pulmonary disease [1]. Broadly speaking, health behaviour change involves the modification of a person's lifestyle behaviour(s) in order to mitigate or prevent a more serious health complication. Common health behaviour changes include: quitting smoking, improving diet, or increasing physical activity.

Given the important health benefits of these particular behavioural changes, extensive research has examined effective behaviour change strategies. Foundational work by Michie and Abraham [2] summarize 26 broad and distinct behaviour change techniques, ranging from providing general information to prompting self-monitoring. The scope of these strategies, as well as their permutations, highlight the vast toolbox of recognized behavioural techniques that can be applied to a specific health behaviour.

Traditionally, psychologists and behavioral specialists use these techniques to discuss goals and formulate plans to change a given behaviour with a client. However, these services can often be expensive and may not always be convenient or accessible by the client. Additionally, the behavioural plan can vary in efficacy due to variability in the specialist's experience, education, and rapport with the client. Similarly, a client's location, demographics, and/or culture may play a role in how effective a plan may be. Even when a behavioral plan is formed and prescribed, behavioral change is not guaranteed [3].

Taken together, the wide variety of behavioural techniques and the complexity of the client/specialist relationship pose a barrier to how effective and sustainable a health behaviour change plan can be [3]. Despite the numerous variables that must interact with and around each other, behaviour change interventions can be successful [4]. Moreover, many of the factors that contribute to the success of a behaviour change technique (*e.g.*, motivation, barriers, resources) are common amongst individuals. Hence, matching behaviour change techniques to these factors can help to enable successful behaviour change. A promising solution to identifying which behavioural strategies will be most effective for the individual is artificial intelligence.

Artificial Intelligence (AI) is a broad term that describes the science and engineering of making intelligent machines [5]. Although there are several types of AI, the power of an AI is derived from data, and "learning" from data. Supervised learning is a technique for teaching AI whereby labeled examples are given to the system, in order for the system to be trained [6]. When applied to the context of health behaviour change, data about an individual's demographics, location, and other outcomes of interest would be cross-referenced against the behaviour change technique(s) used, and subsequently labeled as either successful or unsuccessful. Through data collection and compilation, an AI would hypothetically be able to determine which behaviour change technique would likely result in successful behaviour change, based upon an individual's data. Realistically, the AI would work in tandem with a specialist in order to deliver the behaviour change techniques. A present-day example of this technological partnership is the use of AI in assisting radiologists in image classification (*e.g.* cancer [7]).

Using AI as a means of facilitating behaviour change has numerous advantages. The adaptability and reiterative learning process of AI means that the output (*i.e.* recommendations) would be constantly updated and tailored to reflect new data. For example, if barrier identification as a technique for improving diet is found to be less effective for individuals in a certain area, due to the limited number of healthy options, then the AI would identify this strategy as being less effective and can recommend an alternative strategy to a specialist. Vice-versa, this learning can be informed by the specialists themselves. If a specialist encourages the use of a specific technique, at the recommendation of the AI, then they can evaluate how effective the technique(s) is, based upon the outcomes of the client. The delivery of the AI can also influence it's potential. If the AI can be incorporated into an app or device, then it may be able to collect objective data to learn from. By the same vein, it also becomes possible to intervene ecologically with the client. For example, assume a client wants to improve their diet. However, the AI on their phone detects that they are in close proximity to a fast food restaurant and applies an ecological intervention of providing information on the consequences of eating fast food. Regardless of the choice of the client, the AI is then able to collect data on whether the strategy was successful or not. These aggregated data can also be scaled upwards to inform behavioural change interventions in larger populations or groups.

The potential for AI for positively influencing and informing health behaviour change is enormous. The ability to assist behaviour specialists in implementing and refining successful behavioral strategies has tremendous benefit for health and healthcare. Ultimately, AI provides a promising and adaptable solution to what has long been the important, albeit complex, science of health behaviour change.

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