

Towards evidence-based smartphone apps to enhance human health: Adoption of behavior change techniques

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Abstract:

There has been a substantial increase in the number of health-related smartphone applications (apps) available to consumers in recent years. How does one decide which apps have scientific evidence backing their claims and which are “fake news”? In this Commentary, we explore the hierarchy of scientific claims and review recent literature to identify areas of Health Education and health promotion in which evidence-based smartphone apps are available. Further, we present a theory-based framework to help app developers optimize their potential to enhance human health.

Keywords: smartphone applications | apps | health education | behavior change techniques

Article:

Introduction

The recent acceleration of smartphone technology and its integration within our daily life has afforded the opportunity to develop applications (apps) marketed to enhance human health, which is attractive to a large sector of society as evidenced by the growing number of apps available on the market. As of December 2017, the number of apps categorized in the Health and Fitness category was 95 245¹ in the iTunes App Store and 103 518² in the Google Play store, representing a four- to fivefold increase in the number of apps in that category available since May 2013.³ A national survey of over 1600 people indicated that 58% of the respondents had downloaded an app focused on human health,⁴ a number that is likely higher now since the number of apps available has substantially increased in recent years.

With this increase in the development and adoption of health-related apps, one may wonder who is behind all of this development and what their motivation may be. The pathway to develop

apps with a human health focus is relatively open. Thus, individuals, small businesses, nonprofits, and large corporations alike are free to develop and make available apps as they see fit. One could argue that this type of open marketplace has the advantage of accessibility from both a developer and consumer perspective. However, questions about motives and regulation have been raised,⁵ and the lack of accepted frameworks to consistently guide health-related app development has led to this revolution being termed “The Wild Wild West.”⁶ Thus, what guidance is available to help Health Education and health promotion practitioners sift through the vast number of smartphone apps to determine which to recommend to their stakeholders/clients/patients to enhance human health? Do some health-related apps lack evidence supporting their claims, thus utilizing misleading information focused on increasing the number of app downloads rather than the goal of enhancing human health? In line with this special issue on “Effective Communication in a Fake News Environment: The Role of Health Education,” we provide some suggestions to health practitioners on how to evaluate smartphone apps marketed to enhance human health, along with outlining the role that a behavioral change technique (BCT) framework can have for researchers to more holistically demonstrate the utility of such apps.

Levels of evidence-based support

The consequence of an app lacking evidence-based support depends on its intended use. For example, if an app claims to accurately monitor cardiac activity, a consumer may overly rely on the app’s information and not attend to other signs/symptoms that indicate a potential cardiac dysfunction. This automatization of human health monitoring can be problematic even with evidence-based apps, but it makes the patient especially vulnerable if there is no scientific data supporting the app’s claims. To this end, the U.S. Food & Drug Administration (FDA) has developed guidance for mobile medical applications,⁷ some of which are regulated by the FDA. Thus, consumers are encouraged to research whether their app is FDA approved, which would provide some reassurance that the claims made by the app are evidence based.

For the general consumer, it may be difficult to determine whether an app has any scientific evidence at all supporting its implementation, let alone its level of evidence-based support. As a first step, health practitioners and consumers should determine whether any peer-reviewed scientific evidence supports the claims made by the app. The lack of such evidence does not necessarily mean that the app does not have any value. It simply means that there is no evidence supporting its implementation; thus, the consumer should be less confident in what the app can offer.

If there is scientific evidence supporting the app, then it is helpful to understand how to evaluate the different levels of evidence-based support. Rychetnik and colleagues reviewed criteria developed by a variety of groups designed to evaluate the value of scientific data.⁸ In general, the lowest level of scientific support is expert opinion, followed by a case study, a single cohort study, and a single randomized controlled trial (RCT). The RCT is viewed as high-level scientific support because it provides the strongest scientific design to eliminate bias. Moreover, systematic reviews and meta-analyses are approaches that evaluate the effectiveness of multiple studies focused on a similar problem. Thus, a systematic review or meta-analysis of a series of RCTs represents the highest level of evidence-based support that can be obtained. Relative to

human health, systematic reviews and/or meta-analyses have been conducted for smartphone apps focusing on pain monitoring and management⁹⁻¹²; the prevention, detection, and management of cancer^{13,14}; physical activity monitoring and intervention^{3,15-17}; weight management¹⁸; diabetes management^{19,20}; stress management^{21,22}; smoking cessation²³; and the prevention of cardiovascular disease.²⁴ Though these reviews demonstrate that there is high-level evidence-based support for some apps designed to enhance human health, very few scientific papers have adopted a framework designed to understand and manipulate the nuances of behavior change relative to their application.

A framework to determine and enhance utility: Behavior change techniques

Whether a health-related smartphone app is marketed as an assessment, monitoring, or intervention app, the desired outcome is typically the same—a change in behavior. In all cases, the goal is to give users information about their current health status and/or trends in their behavior as a way to encourage them to adopt a healthier lifestyle. For example, physical activity monitoring apps commonly record the number of steps taken. This information is designed to let users know whether they are reaching the daily recommended number of steps and/or their user-defined goal of exercise. If not, features are typically built into the app that encourage users to take more steps throughout the day if they are short of the goal. Thus, the app’s goal is to encourage a change in behavior—taking more steps in this example.

Though behavior change is a key desired outcome in many Health Education and health promotion fields, an underlying theoretical framework to characterize and ultimately help prescribe changes in behavior is not always adopted. Recent reviews evaluating the effectiveness of app-based interventions found that very few apps integrated behavior change theories into their interventions.^{15,25} This type of atheoretical approach leads to a disconnect, where theoretically derived face-to-face intervention components known to be effective in behavior change are absent from technology-based interventions.²⁶ Systematically linking theoretical constructs to an individual intervention component is crucial for effective and efficient intervention design, implementation, and evaluation. Using a theoretical framework rooted in BCTs could help researchers better understand the utility of their apps and allow the developers to add key intervention components—such as goal setting, providing feedback, incorporating social support, behavioral modeling, identification of barriers, and relapse prevention—that could lead to greater adoption and/or maintenance of the desired behavior.

The first taxonomy systematically linking BCTs to theoretical constructs was established by Abraham and Michie.²⁷ This taxonomy was important to develop, because BCTs used in an intervention are often not deliberately stated in the literature and not well tethered to existing theory.²⁸ The authors described BCTs as the smallest “active ingredient” in an intervention aimed to change behavior and developed a theory-linked taxonomy to describe these ingredients. This framework was further defined when the original authors and colleagues developed the “BCT Taxonomy v1,” which is a hierarchical taxonomic structure created through iterations of experts labeling, defining, and grouping BCTs from a variety of sources and then comparing interrater agreement to determine which BCTs naturally emerged, along with their hierarchy.²⁹

Despite the “BCT Taxonomy v1” being only a few years old, it has been widely adopted across a variety of fields. This includes scientific research examining behavior change using health-related apps, primarily with apps focused on physical activity interventions.^{3, 17, 30-32} Moving forward, researchers engaged in the development of evidence-based smartphone apps focused on human health could enhance the efficacy of their app by using “BCT Taxonomy v1” to help prescribe particular features to enhance behavioral change based on theory. Adopting such a systematic, theoretically based framework will allow health professionals to better understand the processes influencing behavior and ultimately help move this revolution from “The Wild Wild West” toward evidence-based support that is the foundation of modern health-related professions.

Conclusion

As health-related apps become more widely adopted by society, Health Education and health promotion practitioners face the challenge of deciding which apps are useful to help promote healthy lifestyle behaviors. Apps that are supported by evidence-based scientific data may cost more due to the associated research and development, but that added cost comes with the reassurance that commercialization was not the sole motivation behind the marketing of the app. Further, researchers wishing to optimize a health-related apps should consider adopting the “BCT Taxonomy v1” to help them target particular characteristics known to positively affect behavior change. Collectively, these recommendations will help practitioners in health-related fields take advantage of the integrated role of smartphones within our lives in order to gather data and interact act with their patients/clients in ways that could not be done before, while adhering to evidenced-based principles and theory-driven frameworks known to advance behavior change. If adopted, the future of evidence-based apps is bright, because they could further the ongoing movement of continuous data collection and real-time analysis tailored to enhance human health.

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