



Comparing usage of a web and app stress management intervention: An observational study

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ABSTRACT

Choices in the design and delivery of digital health behaviour interventions may have a direct influence on subsequent usage and engagement. Few studies have been able to make direct, detailed comparisons of differences in usage between interventions that are delivered via web or app. This study compared the usage of two versions of a digital stress management intervention, one delivered via a website (Healthy Paths) and the other delivered via an app (Healthy Mind). Design modifications were introduced within Healthy Mind to take account of reported differences in how individuals engage with websites compared to apps and mobile phones. Data were collected as part of an observational study nested within a broader exploratory trial of Healthy Mind. Objective usage of Healthy Paths and Healthy Mind were automatically recorded, including frequency and duration of logins, access to specific components within the intervention and order of page/screen visits. Usage was compared for a two week period following initial registration. In total, 381 participants completed the registration process for Healthy Paths (web) and 162 participants completed the registration process for Healthy Mind (app). App users logged in twice as often ($Mdn = 2.00$) as web users ($Mdn = 1.00$), $U = 13,059.50$, $p \leq 0.001$, but spent half as much time ($Mdn = 5.23$ min) on the intervention compared to web users ($Mdn = 10.52$ min), $U = 19,740.00$, $p \leq 0.001$. Visual exploration of usage patterns over time revealed that a significantly higher proportion of app users ($n = 126$, 82.35%) accessed both types of support available within the intervention (i.e. awareness and change-focused tools) compared to web users ($n = 92$, 40.17%), $\chi^2(1, n = 382) = 66.60$, $p < 0.001$. This study suggests that the digital platform used to deliver an intervention (i.e. web versus app) and specific design choices (e.g. navigation, length and volume of content) may be associated with differences in how the intervention content is used. Broad summative usage data (e.g. total time spent on the intervention) may mask important differences in how an intervention is used by different user groups if it is not complemented by more fine-grained analyses of usage patterns over time. Trial registration number: ISRCTN67177737.

1. Introduction

Health and behaviour change interventions delivered using digital technology offer the potential to automatically collect rich data on how

the intervention has been used by individual participants. This data can range from summative metrics (e.g. number of logins, duration of logins, frequency of visits to particular intervention components) to fine-grained individual-level data detailing each individual's flow through

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the intervention (e.g. what has been visited, for how long and in what order) (Morrison and Doherty, 2014). Analysis of this data is crucial for identifying factors associated with variations in intervention usage (e.g. design factors, user characteristics), and for informing understanding of the relationship between intervention usage and health-related outcomes.

To date, numerous intervention evaluation studies have used summative metrics to report broad patterns of intervention usage and how these relate to outcomes (e.g. Glasgow et al., 2011; Richardson et al., 2013; Whitton et al., 2015). Other work has sought to analyse user characteristics associated with greater usage of or exposure to the intervention content (e.g. Brouwer et al., 2009; Van't Riet et al., 2010) or compare usage across different interventions that are focused on a particular health condition or behaviour (Nelson et al., 2016). Such analyses can inform conceptual models of engagement that identify user or design-related factors that may enhance engagement with an intervention platform and for identifying user groups for whom the intervention is likely to be most engaging and effective (Perski et al., 2016).

In addition to broad summative-level metrics, some digitally delivered interventions offer the opportunity to collect and analyse rich individual-level data on how the intervention is used and engaged with over time. Systematic analysis and interpretation of such data is methodologically challenging (Morrison and Doherty, 2014) and there is a lack of guidance available in how best to approach usage analyses to enable comparability and applicability across studies. Visual exploration of intervention usage has shown promise as a way to supplement summative usage metrics by providing a more efficient means of exploring large, richer data sets at finer levels of granularity (e.g. Arden-Close et al., 2015; Morrison and Doherty, 2014).

Increasing proliferation of digital interventions and rapid advancement in technology also raises empirical questions about the choice of platform for delivering health behaviour change interventions. For example, to what extent are usage patterns influenced by the design of interventions delivered through different digital platforms (i.e. web versus app)? Few studies have directly compared the usage of interventions delivered through different digital platforms. Morrison et al. (2014) compared usage of an online weight management intervention when provided with or without a supplementary app. This study suggested that combining web and app delivery can help to improve users' awareness of their personal weight management goals, but did not directly compare web and app delivery of the intervention content. Quinonez et al. (2016) directly compared email versus SMS delivery of an intervention to promote physical activity. Their analysis demonstrated that email delivery was associated with lower rates of drop out and higher self-reported engagement with the tailored physical activity messages (e.g. number of messages received and read). This study suggests that there may be differences in how interventions are used and responded to as a result of how they are delivered through the digital technology.

Comparing web and app delivery of an identical intervention is problematic as qualitative research suggests that individuals are likely to engage differently with websites and apps in their day-to-day lives. Dennison et al. (2013) highlighted that apps were perceived as disposable and not necessarily seen as a long-term commitment. Morrison et al. (2014) also found that app content was typically used on-the-go, sporadically for shorter periods of time than web content. Mobile screen space is also more limited than on PCs. Thus, comparison of exactly the same content delivered via different digital platforms (as reported in Quinonez et al., 2016) is likely to influence the conclusions drawn about usage and engagement as no account is made in the design and delivery of the intervention of how individuals use different digital platforms within their day-to-day lives. Duplicating a design originally intended to be accessed via email or on a PC may well result in lower engagement when accessed through mobile platforms if appropriate modifications for mobile delivery are not made (Lattie et al., 2016).

To our knowledge, this study is one of the first to provide a detailed, direct comparison of usage of a web and app intervention that made modifications to take account of how these different platforms are used within individuals' daily lives. The aims of the study were to:

1. Compare patterns of usage between a web and app stress management intervention.
2. Compare insights gained from two approaches to analysing intervention usage data. These included descriptive statistics of summative level data versus visual exploration of individual-level data and temporal usage of the intervention.

The design differences between the web and app versions mean that users did not receive identical versions of the intervention. This study therefore compares two intervention packages that share the same underlying 'theoretical action components' (i.e. to support users in applying mindfulness-based and cognitive behavioural strategies to help manage stress and improve mental wellbeing), but differ in their 'instantiation' (i.e. sequence of delivery, volume of content) (Mohr et al., 2015). The aim of the presented analysis is not then to draw conclusions about whether web or app delivery of identical intervention content is associated with more desirable usage patterns, but rather to provide insight about how choices in the delivery of intervention content may relate to potentially crucial differences in usage and receipt of the intervention.

2. The interventions

2.1. *Healthy Paths (web)*

Healthy Paths through Stress (short name 'Healthy Paths') is an online intervention that offers a range of evidence-based tools for managing emotional distress. Healthy Paths was created using LifeGuide intervention authoring software (<http://www.lifeguideonline.org>) following a person-based approach (Geraghty et al., 2016). The tools provided by Healthy Paths are drawn from mindfulness-based approaches and cognitive behavioural therapy (see Table 1). Each tool was designed to support participants to improve awareness of their thoughts or behaviours or support change in thinking patterns and behaviours. The content and design of Healthy Paths was developed by a multi-disciplinary team comprised of psychologists and clinicians in close collaboration with primary care patients who were experiencing distress primarily stemming from stressful life circumstances. Healthy Paths was designed to support users in managing emotional distress and was not intended as an intervention for psychological disorders (e.g. depressive disorder or generalised anxiety disorder).

2.2. *Healthy Mind (app)*

Healthy Mind is an Android app that was adapted from the Healthy Paths website and was created using the Life Guide Toolbox software (Hargood et al., 2014). Healthy Mind provides the same basic content as Healthy Paths, that is, the same range of 'tools' (see Table 1). However, the volume and delivery of content provided by the app was adapted in specific ways to better accommodate how individuals were perceived to routinely engage with their mobile phones on a day-to-day basis. Key differences between the web and app versions of the intervention are described in detail in Section 2.3.

2.3. *Summary of key differences*

Three design changes were introduced in the app version of the intervention: 1) simplifying the navigation of the app and introducing a tool unlocking feature (see Section 2.3.1), 2) simplifying and reducing the content of the app to enable faster access to the core tools (see

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