Standalone Apps for Anxiety and Depression Show Promising Early Efficacy: A Commentary on Meta-Analytic Results

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Abstract

The current commentary is focused on the methods and conclusions drawn in a recent meta-analysis which evaluated the impact of standalone interventions in treating anxiety and depressive symptoms (Weisel et al., 2019). The current commentary discusses the large impact of methodological choices made to exclude transdiagnostic treatments and group heterogeneous treatments on study conclusions. Additionally, the current commentary evaluates these conclusions considering opposing from two additional meta-analytic findings. The current review concludes that more research is needed effects before drawing any definitive conclusions, but the current evidence base suggests that apps show promising early efficacy in treating anxiety and depressive symptoms.

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Given the high incidence of anxiety and depressive disorders and the very few persons who receive treatment for these disorders (Wilhelm et al., 2020), researchers have become increasingly interested in standalone treatments for anxiety and depression. As the ubiquity of smartphones has grown across the globe, both academia and industry alike are increasingly developing and testing standalone smartphone apps targeting anxiety and depressive symptoms. A recent meta-analysis summarized and concluded that smartphone apps targeting mental health contribute to significant reductions in depressive symptoms (Hedges' $g = 0.33$) but no significant reductions in anxiety symptoms (Weisel et al., 2019). The paper concludes that "Although some trials showed potential of apps targeting mental health symptoms, smartphone apps as standalone psychological interventions cannot be recommended based on the current level of evidence". The current comment further evaluates the evidence base for making these summary claims.

Strength and Efficacy when Including Transdiagnostic Treatment Impacts. Despite the substantial literature which has developed in the last decade surrounding the efficacy of transdiagnostic digital interventions in treating anxiety and depressive disorders (Wilhelm et al., 2020), the abstract and conclusions cite several papers where anxiety or depressive symptoms were the *only* target. Moreover, it results in a substantial decrease in the potential evidence base of the targeted *N*, as well as a substantial decrease in the confidence bounds surrounding the estimates. This effect on confidence bounds was particularly large for anxiety for which the confidence intervals ranged from -0.1 to 0.7. Moreover, for both anxiety and depression, not only do the effect size of confidence intervals decrease when transdiagnostic interventions are included, but also the estimated effect sizes increase.

Two Published Meta-Analyses with More Studies and More Trials Suggest Strong Efficacy. Additionally, Weisel et al.'s (2019) conclusions about the limited evidence base were likely principally based on the restrictive inclusion criteria (see Table 1). Two prior meta-analyses have been published on treating anxiety and depressive symptoms using smartphone-based methods (Firth et al., 2017). Weisel et al. (2019) based their conclusions about depression on six studies, four of which were included in another meta-analysis. The prior meta-analysis (Firth et al., 2017) included a total of 3,414 participants and included an additional randomized controlled trial targeting primary depression not contained within the Weisel et al. study (Watts et al., 2013). This study found significant symptom reduction in both standalone mobile and computer intervention groups with non-significant means favoring the mobile group over the computer group (Watts et al., 2013). Within anxiety, a prior meta-analysis included more participants, and an additional study testing the standalone efficacy of an app-based intervention (Firth et al., 2017). This study found a significant reduction in trait anxiety after four weeks for the app-based experimental group but not for the control group (g = 0.156), as well as significant reduction in state anxiety after each usage of the app-based intervention which was significantly greater than the control group (average g = 0.755) (Villani et al., 2013). These studies illustrate the efficacy of app-based interventions in reducing depressive and anxiety symptoms. Additionally, both prior meta-analyses included risk of bias assessments performed using Egger's test and trim-and-fill analyses, with no evidence of publication bias found in either. Thus, the criteria leading to the exclusion of these studies from the Weisel et. al. meta-analysis should be more fully addressed, given their contributions to the current body of evidence and the prior meta-analyses.

Additionally, Weisel et al. state in the Limitations section of their Discussion that "Due to the small amount of studies per disorder, the number of comparisons per disorder was limited, therefore not all study effects could be pooled, subgroup analyses were restricted, follow-up assessments were not examined, nor was publication bias explored." Given the importance of inclusion/exclusion criteria in these meta-analyses, we believe that publication bias should be more fully reported. We acknowledge that Weisel et al. performed risk of bias assessment using Egger's test and trim-and-fill analyses, and we would respectfully suggest that the authors more fully the results of these analyses and explore the results of their assessment so as to conform to the standard established by the prior meta-analyses.

High Heterogeneity Studies. Notably, Weisel et. al describe the importance of doing the current meta-analysis in part because prior meta-analyses included apps which targeted "attentional control". Unfortunately, the same weakness is found in the current review, given that attention bias modification was present in two of the four comparisons conditions included in the evaluated anxiety studies which informed the primary study conclusions. We agree with Weisel et al.'s own concerns about including these types of articles as they differ substantially from the other types of treatment, such as intervention reminders based on adherence monitoring, offered in applications (Weisel et al., 2019). However, the decision to include this study while simultaneously excluding many other studies which evaluated the treatment impact on anxiety symptoms leads to very imprecise parameter estimates. Here we believe the inclusion of attentional bias modification studies, including Enock et al. and Clarke et al., are so qualitatively different from the rest of the studies that the pooled comparison loses potential meaning (Clarke et al., 2016; Enock et al., 2014).

Appropriate Comparison Condition for Standalone Technology-Based Treatments Is No Treatment At All. The evidence base suggests that app-based interventions lead to significant and superior reductions in anxiety and depressive symptoms in app interventions broadly. However, the authors conclude that "standalone smartphone apps cannot be recommended" (Weisel et al., 2019). These recommendations appear to be outside the scope of the meta-analysis itself. The arguments appear to be driven by one or both of two sentiments: (1) the interventions may not have the effect sizes of traditional interventions or (2) the interventions, when evaluated qualitatively, do not appear to reach the magnitude achieved in internet interventions. Based on the aforementioned literature demonstrating the efficacy of app interventions in reducing anxiety symptoms, both these premises are overreaching and do not appear to reflect the evidence base (Firth et al., 2017). Firstly, most persons do not receive any mental health treatment when they have an anxiety or depressive disorder; from the National Comorbidity Survey Replication conducted in the US, Wang et al. (2005) found substantially lower treatment contact for anxiety (27.3% - 95.3%), impulse control (33.9%-51.8%), and substance disorders(52.7%-76.9%). Furthermore, even when they do engage in health seeking behavior, in-person treatment is often delayed for weeks or months; Wang et al. (2005) found delays in initial treatment contact of as long as 23 years for anxiety disorders in the US while Trusler et al. (2006) found average wait times of as long as 20 weeks between first assessment to referral to first therapy in the UK's NHS. Consequently, the idea that standalone treatment apps for anxiety and depression should inherently match traditional in-person treatment is not the most appropriate comparison. In contrast, apps offer immediate treatment to afflicted individuals who are awaiting an in-person appointment. The alternative, suggested by those who criticize technology-based treatment, is no treatment at all. In regard to the direct qualitative comparisons

made in the discussion by the authors, the claim that internet-based interventions appear to have a stronger efficacy than apps based on the reported effect sizes is misguided because the only studies which have directly compared the effects of app-based treatments with internet-based treatments for anxiety and depression have found either no significant differences between the two or significant differences favoring apps (Dagöö et al., 2014; Watts et al., 2013). There is even some evidence that adding an app to internet based treatment may aid internet-based treatments (Boettcher et al., 2018). Ivanova et al. (2016) found no large differences between an unguided app-based internet intervention compared to a therapist guided app-based internet intervention. Thus, contrary to the authors' summaries, apps for anxiety and depressive disorders significantly reduce anxiety and depressive symptoms with a medium effect size when compared to no treatment at all, and the current evidence suggests similar or marginally superior performance of apps to internet based interventions. However, conclusions here are quite premature as very few studies have been conducted.

Conclusions from the Body of Evidence Amassed Across the Three Meta-Analyses as Well as Other Standalone Studies. Given that the meta-analysis only included one new study while simultaneously excluding several studies included in two other meta-analyses on this topic, it is important to interpret the totality of the evidence. The totality of the evidence clearly suggests that the typical standalone intervention which has been tested to treat anxiety and depressive symptoms in randomized controlled trials demonstrates significant and superior efficacy compared to waitlist control conditions, that app-based interventions appear to be approximately or marginally superior to internet-based applications, and that the type of the design of the smartphone application has a large impact on the efficacy with more traditional cognitive-behavioral interventions demonstrating promising early efficacy in apps. Given the

potential benefit standalone app-based interventions have compared to the appropriate no treatment comparison condition and lack of any evidence suggesting negative effects, the current level of evidence is adequate to recommend further investigation and trial of these interventions. Clearly more research is needed before drawing definitive conclusions, including examining the performance of applications outside of highly developed countries. We recommend further research examining standalone app-based intervention effects before drawing any definitive conclusions, but the current evidence base suggests that apps show promising early efficacy in treating anxiety and depressive symptoms.

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Table 1

Summary of Meta-Analyses, Inclusion Criteria, and Effect Sizes

Study	Number of Studies and Sample Size	Inclusion Criteria	Effect Size
Firth et al., 2017a	18 studies; 3,414 participants	(1) Published in English (2) Randomized controlled trial (3) Evaluated the impact of mental health interventions including depressive symptoms as an outcome (4) Intervention delivered via smartphones	*g* = 0.56, 95% CI: 0.38-0.74 compared to inactive controls treating depression *g* = 0.22, 95% CI: 0.10-0.33 for active controls treating depression;
Firth et al., 2017b	9 studies with 1,837 participants	(1) Published in English (2) Randomized controlled trial (3) Reported change in anxiety following mental health intervention (4) Intervention delivered via smartphones	*g* = 0.325, 95% CI: 0.17–0.48 for anxiety
Weisel et al., 2019	6 for depression; N = 796 4 studies for anxiety; N = 479	(1) Peer-reviewed, published in English or German (2) Randomized controlled trial (3) Evaluated standalone intervention for specific mental health domain (4) Delivered via smartphone app (5) Attempted to reduce symptoms of a disorder or self-injurious thought or behavior (6) Adult population (7) Heightened symptom severity at baseline (8) Evaluated disorders or symptom cutoffs and the symptom was the primary outcome (9) Included a control group	*g* = 0.33, 95%CI: 0.10–0.57 for depression *g* = 0.30, 95% CI: −0.1 to 0.7 for anxiety