

# INPLASY PROTOCOL

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## What Processes of Change Do Mindfulness Apps Impact? A Systematic Review

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**Support:** None.

**Review Stage at time of this  
submission:** Data extraction.

**Conflicts of interest:**  
None declared.

**Review question / Objective:** To summarize the published evidence on the impact of mindfulness apps on the psychological processes known to mediate transdiagnostic symptom reduction after mindfulness practice. This review focuses on randomized controlled trials (RCTs) that evaluated commercially available mindfulness-based mobile apps in adult (>18 years old) populations with validated and reliable outcome measures.

**Condition being studied:** Mechanisms of mindfulness practice, or the processes of change that explain the downstream effects of mindfulness practice on such disorders as depression and anxiety. This review focused on a list of theoretically and empirically supported mechanisms.

**INPLASY registration number:** This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 04 May 2023 and was last updated on 04 May 2023 (registration number INPLASY202350017).

(>18 years old) populations with validated and reliable outcome measures.

**Rationale:** Recent reviews on the topic suggest that mindfulness app effects on depression are generally small and results for anxiety are inconsistent.<sup>10,11</sup> However, the common approach of evaluating app effects on such distal mental health outcomes as anxiety and depression is problematic because app intervention

## INTRODUCTION

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periods tend to be too brief for distal mental health outcomes to demonstrate significant and consistent change. A more suitable approach to reviewing mindfulness app efficacy maybe to focus on the more proximal processes of change, or mechanisms, that have been empirically demonstrated to explain the effects of mindfulness practice on distal psychological outcomes. Temporally, these mechanisms shift first and may provide a clearer picture of the efficacy of mindfulness apps. Adopting a mechanisms-as-outcomes approach has two additional benefits. First, the knowledge gained from such an approach can lead to more targeted apps and enhance their efficacy. Second, this approach provides valuable insights for clinicians specializing in evidence-based treatments, as many of the mechanisms of mindfulness practice are also the transdiagnostic mechanisms targeted in these therapies.<sup>12,13</sup> Therefore, knowledge gained from this approach can aid clinicians to evaluate such apps as potential complements to ongoing treatment goals. To date, no mindfulness app review of which we are aware has focused on the mechanisms of mindfulness training as outcomes. Thus, a systematic review is warranted to investigate the evidence of mindfulness app effects on the mechanisms through which mindfulness training is known to influence transdiagnostic symptom change.

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## METHODS

**Search strategy:** An electronic literature search was performed by the first author on October 26, 2022, on Pubmed, APA PsycINFO, and Web of Science. Our keyword search on Pubmed (which was also used for each additional database) was as follows: ((mindful\*[Title/Abstract]

OR meditat\*[Title/Abstract])) AND (("smartphone"[MeSH Terms] OR "smart phone"\*[Title/Abstract] OR smartphone\*[Title/Abstract] OR "smart phone"\*[Title/Abstract] OR smartphone\*[Title/Abstract] OR cellphone\*[Title/Abstract] OR "cell phone"\*[Title/Abstract] OR cell-phone\*[Title/Abstract] OR "cellular phone"\*[Title/Abstract] OR mobile\*[Title/Abstract] OR "mobile phone"\*[Title/Abstract] OR "mobile device"\*[Title/Abstract] OR "mobile health"\*[Title/Abstract] OR app[Title/Abstract] OR apps[Title/Abstract] OR application\*[Title/Abstract] OR mobile-based[Title/Abstract] OR "mobile based"\*[Title/Abstract] OR digital[Title/Abstract] OR "digital health"\*[Title/Abstract] OR iphone\*[Title/Abstract] OR android\*[Title/Abstract] OR mhealth[Title/Abstract] OR m-health[Title/Abstract] OR tablet-based[Title/Abstract] OR ipad[Title/Abstract] OR "app delivered"\*[Title/Abstract] OR app-delivered[Title/Abstract])).

**Participant or population:** Adults, 18 years old and older.

**Intervention:** Mindfulness-based app (defined as any app whose content was mostly or entirely (> 95%) focused on facilitating mindfulness practice).

**Comparator:** Active (e.g., a non-mindfulness app or in-person MBSR) or passive (e.g., waitlist) control group.

**Study designs to be included:** Only RCTs.

**Eligibility criteria:** To be included in this review, a study had to a) be a randomized controlled trial design, b) examine a mindfulness-based mobile app, c) assess change in at least one mechanism from our list of outcomes using a validated and reliable measure, d) focus on an adult sample (>18 years old), and be e) peer-reviewed and f) written in English. We excluded studies on Web-only or text-based interventions, as we were most interested in apps for their accessibility and scalability. To avoid sample biases, we also excluded studies of non-smartphone technology (e.g., VR, wearables, tablets), as

these technologies are not yet widely adopted. Finally, regarding validated measures, we made an exception for any EMA studies, which need to use few items to reduce participant burden.

**Information sources:** Electronic databases.

**Main outcome(s):** Any one mechanism from our pre-determined list of accepted outcomes. That is: Decentering/defusion; Self-regulation; Values clarification; Acceptance/psychological flexibility; Awareness; Nonreactivity; Attention regulation; Reappraisal; Extinction; Suppression; Worry; Rumination; Non-judgment; Positive Affect.

**Additional outcome(s):** N/A.

**Data management:** Zotero and Excel were used to manage records. Studies identified were divided among four pairs of reviewers. Reviewers independently assessed studies based on title and abstract and gave inclusion/exclusion recommendations on an excel sheet created by the first author of this review specifically for the review process. Recommendations were subsequently compared; any disagreements were resolved through discussion in each pair.

**Quality assessment / Risk of bias analysis:** The Quality Assessment Tool for Quantitative Studies, which has evidence of validity and reliability, guided the quality assessment process. The tool outlines criteria for the assessment of eight domains of bias in each study.

**Strategy of data synthesis:** The range of clinical and methodological characteristics in the studies included in this review prevented a meta-analysis. Thus, a narrative synthesis of the data is more suitable.

**Subgroup analysis:** Subgroups analysis will be conducted in terms of outcome, gender, and any other demographic differences that appear.

**Sensitivity analysis:** N/A.

**Language restriction:** English.

**Country(ies) involved:** United States.

**Keywords:** mindfulness, digital, smartphone, apps, mechanisms, depression, anxiety.

**Dissemination plans:** Findings will be published in a peer-reviewed journal and further disseminated through publications at national and international scientific conferences.

**Contributions of each author:**

**Author 1 - Natalia Macrynika -** Conceptualized the review, is the lead on each process of the review (screening, full-text review, data extraction, QA), as well as writing and editing of the manuscript.  
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