Impact of Guidance and Personalisation on Mobile Mindfulness for Depression and Anxiety: A Systematic Literature Review and Meta-Analysis

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Abstract

Globally, anxiety and depression are two of the most common mental health disorders. Yet, access to adequate treatment remains sparse. Smartphone-based mental health apps (mHealth apps), particularly mindfulness-based mobile apps, can be effective in addressing this issue. To enhance the effectiveness of these mindfulness apps, this study investigates the independent and combined effects of guidance and personalisation on the reduction of anxiety and depression symptoms. Therefore, the research question addressed in this study is: "Does the inclusion of personalisation and guidance in mobile mental health interventions with mindfulness lead to greater improvements in the effectiveness of therapy compared to mindfulness-only interventions for individuals with anxiety and depression?". This is realised by conducting a systematic literature review and meta-analysis of 45 RCTs of mindfulness-based mobile apps, calculating within-group Hedges' g and performing a between-group meta-analysis. Covariate effects are accounted for as well (age, gender, clinical status, comorbidity). Mindfulness-only apps significantly reduced both depression and anxiety, the inclusion of guidance further enhanced the impact on depression, and combined guidance and personalisation improved both anxiety and depression symptoms. After adjusting for covariates, only the reduction of depression in the mindfulness-only condition remained significant. Forest plots confirm generally small but robust effects. All in all, the mindfulness-only condition was effective for anxiety and depression, adding both guidance and personalisation further enhanced outcomes. Moreover, while adding guidance alone improved depression significantly, personalisation alone did not show added benefit. These findings should be interpreted in light of the study's limitations, highlighting the need for more rigorous research.

Keywords: Guidance, Personalisation, Therapy Effectiveness, Mobile Mental Health Interventions With Mindfulness, Systematic Literature Review, Meta-Analysis

Impact of Guidance and Personalisation on Mobile Mindfulness for Depression and Anxiety: A Systematic Literature Review and Meta-Analysis

Two of the most common mental health conditions in the world are anxiety and depression (Kalin, 2020). According to Javaid et al. (2023), anxiety disorders usually start early in life and can result in several additional health issues if ignored. In primary care settings, anxiety disorders are frequently underdiagnosed and undertreated, even though their increasing prevalence worldwide constitutes a severe danger to public well-being and quality of life (Bandelow et al., 2017). In a similar vein, depression severely hinders the capacity of an individual to operate daily and their level of life satisfaction. It is a substantial contributor to suicide fatalities as well. Despite its significant incidence and impact, the majority of individuals with depression are unable to access adequate treatment (Moreno-Agostino et al., 2020).

There is a substantial disparity between the need for mental health resources and their availability. Mental health challenges continue to rise, globally affecting approximately a billion people each year (Torous et al., 2021). However, the available mental health services are insufficient to meet the demands of this large population. As a result, individuals in need of help encounter problems such as long waiting lists, a shortage of trained professionals, geographic limitations, and a lack of identifiability (Eichstedt et al., 2024; Kieling et al., 2011; Linardon et al., 2019). To address this burden, digital health technologies have rapidly advanced, providing versatile, cost-effective and readily available alternatives for mental health treatment (Torous et al., 2021).

Correspondingly, smartphone-based mental health apps (mHealth apps) can be effective in shaping the future of mental health care. In this current study, they are defined as applications designed for use on smartphones, explicitly targeting mental health conditions (e.g., anxiety, depression, and schizophrenia), symptoms (e.g., depressive symptoms), or

well-being (e.g., emotional health). mHealth apps may offer a range of therapeutic techniques, including psychoeducation, symptom tracking, or skill-building to support mental health improvement (Bakker et al., 2016; Chandrashekar, 2018; Diano et al., 2023). Furthermore, mHealth apps can help individuals overcome financial, social, or geographic challenges, as well as raise awareness of available mental health care and encourage individuals to seek treatment (Bakker et al., 2016). As a result, mHealth apps are not only versatile but can serve as a useful way to provide easily available and customised mental health assistance as well, signifying their growing role in modern mental health care.

In particular, mindfulness-based mobile apps have gained a significant amount of popularity for improving the well-being of individuals. Mindfulness is defined as paying attention to the present moment with an open, non-judgmental attitude, which may involve practices such as mindful breathing or body scan meditation (Bakosh et al., 2018; Linardon et al., 2024; Roquet & Sas, 2018). A recent systematic review of randomised controlled trials (RCTs) found that apps incorporating mindfulness practices had mostly positive effects on well-being, yet the overall effect sizes were generally small to medium (Schwartz et al., 2023). Moreover, mindfulness apps have grown in popularity as resources for treating the symptoms of anxiety and depression, the two severe mental health issues that affect a significant percentage of people worldwide (Linardon et al., 2023). Similar to the previously discussed systematic review, Linardon et al. (2023) found modest effects of these apps on improving symptoms of anxiety and depression. Accordingly, the majority of research primarily assesses the overall effectiveness of these apps; however, investigating specific intervention characteristics (e.g., interactive components and intervention duration) of mindfulness-based mobile apps may contribute to their efficacy for users as well (Roquet & Sas, 2018; Schwartz et al., 2023).

One key intervention characteristic for the effectiveness of mindfulness-based mobile apps is guidance. Interventions that are guided are programs that include some level of professional support or interaction as part of the therapeutic process, which can be provided by therapists, psychologists, other mental health professionals, or facilitated through the app itself (Linardon et al., 2024; Nunes et al., 2020). For example, the study of Roquet & Sas (2018) mentions auditory guidance in the form of breathing exercises, where users are instructed to "focus on how the air enters the lungs and expands the belly". In other cases, the app could include interactive guidance from a professional therapist (Schultchen et al., 2020). Guidance is a commonly included feature in mindfulness apps, with some studies supporting its effectiveness (Roquet & Sas, 2018; Spijkerman et al., 2016). For example, guided interventions outperformed unguided interventions in terms of effectiveness and engagement rates in mindfulness-based interventions (MBIs) for depression (Strauss et al., 2021). Additionally, it can be equally effective as the face-to-face treatment for anxiety and depression (Cuijpers et al., 2010; Ly et al., 2014). However, the study of Roquet and Sas (2018) highlights a significant gap in the field, stating that while the majority of mindfulness-based apps emphasise guided meditation, they often do not prioritise thoroughly assessing or measuring the effectiveness of this guidance. Thus, although previous research indicates that guided apps generally outperform unguided ones, no review has specifically examined the impact of guidance within smartphone-based mindfulness apps for anxiety and depression. This research can support the improvement and optimisation of these apps for their beneficiaries.

Another intervention characteristic is personalisation, which is described in this study as incorporating it into the intervention, such as the app adjusting content based on user input, providing personalised feedback, having timing rules for intervention delivery, and so on (Linardon et al., 2024; Matthews & Rhodes-Maquaire, 2024). In the study of Parsons et al.

(2019), both mindfulness teachers and participants found personalisation to be an important factor in a mindfulness intervention. Particularly, teachers being able to tailor the app to their students' requirements, such as editing the content of the course, and students having the option to incorporate personalised quotes and practice reminders or adjust the voice-over sound to match the sound of their teacher. Hence, both therapists and users recommend personalisation in digital mental health interventions (Balaskas et al., 2022; Balaskas et al., 2024). However, personalisation generally has mixed evidence of its effectiveness, with some studies showing a positive effect while others report a limited impact (Matthews & Rhodes-Maquaire, 2024). Additionally, research on the benefits of personalisation, specifically the inclusion of personalisation elements within an app, remains limited. Particularly regarding the long-term effectiveness and impact of personalisation across different user groups, further research is needed to fill this gap (Hornstein et al., 2023).

Therefore, additional research is required to assess the effectiveness of personalisation and guidance in mobile mindfulness apps, particularly their impact on individuals suffering from anxiety and depression. This represents a relevant area of research with the potential to enhance the effectiveness of these interventions. The research question that will be addressed and suits this investigation is: "*Does the inclusion of personalisation and guidance in mobile mental health interventions with mindfulness lead to greater improvements in the effectiveness of therapy compared to mindfulness-only interventions for individuals with anxiety and depression?*". To answer this research question, a systematic literature review including a meta-analysis was conducted. As previously outlined, the inclusion of either personalisation or guidance is expected to enhance the effectiveness of mindfulness intervention compared to mindfulness alone. In addition, the study of Linardon (2023) suggests that mindfulness apps could be more effective if they not only offered personalised interventions but also incorporated support features, such as guidance. Consequently, the

independent variables are mindfulness, mindfulness with guidance, mindfulness with personalisation, and mindfulness with guidance and personalisation. Therefore, four intervention conditions are compared in this study, and include a core mindfulness component but differ in the addition of guidance and/or personalisation. The dependent variables are therapy effectiveness for anxiety symptoms and therapy effectiveness for depression symptoms. Thus, the hypotheses (H) associated with the intervention conditions are:

H1: The condition that includes mindfulness, guidance, and personalisation will have the highest therapy effectiveness for anxiety and depression compared to the other three conditions

H2: The condition that includes mindfulness and guidance will have higher therapy effectiveness for anxiety and depression compared to the mindfulness-only condition

H3: The condition that includes mindfulness and personalisation will have higher therapy effectiveness for anxiety and depression compared to the mindfulness-only condition

Method

The research question of this study was investigated by conducting a systematic literature review and meta-analysis. This is a secondary analysis of another project, preregistered on the 17th of January 2025 in PROSPERO (ID: CRD42025630092), which replicated and adapted methods from the study of Linardon et al. (2024) to explore specific characteristics of mobile mental health interventions and their association with improvements in mental health outcomes. Here, we only describe the data procedure relevant for this analysis. For a full description of the method and data analysis, the reader is referred to the study protocol, developed based on the Generalised Systematic Review Registration Form

(Kraiss, 2025; Van Den Akker et al., 2020). The data were systematically gathered and screened prior to the start of this study, and the PRISMA guidelines were utilised throughout this study to clarify every step that was made, which is known to provide transparency and reliable findings (Liberati et al., 2009).

Data Collection

The data collection process began with a systematic search for relevant studies using three databases, namely Web of Science, PsycINFO (EBSCO), and PubMed. As defined in the review protocol, PsycINFO and PubMed were selected to ensure that psychology and biomedical sciences are addressed, while Web of Science was included for its more interdisciplinary focus (Kraiss et al., 2024). The databases were searched in April 2024 using the search string in Figure 2. The search string was adapted to each individual database format. In addition, to find more eligible studies, six meta-analyses on digital and mobile mental health interventions were cross-checked for backwards citation chasing (Firth et al., 2017a; Firth et al., 2017b; Lecomte et al., 2020; Linardon et al., 2020; Linardon et al., 2024; Weisel et al., 2019). Grey literature was not included in this current systematic literature review (Kraiss et al., 2024). Subsequently, the retrieved studies were evaluated based on the inclusion and exclusion criteria summarised in Table 1. Only trials that measured anxiety or depression were selected for inclusion.

Figure 2

Search String Used in the Systematic Literature Review

"smartphone*" OR "mobile phone" OR "cell phone" OR "mobile app*" OR "iphone" OR "android" OR "mhealth" OR "m-health" OR "cellular phone" OR "mobile device*" OR "mobile-based" OR "mobile health" OR "tablet-based" OR "JITAI" OR "just-in-time adaptive"

AND

"random*" OR "trial*" OR "allocat*" OR "RCT" OR "MRT"

AND

"anxiety" OR "agoraphobia" OR "phobia*" OR "panic" OR "post-traumatic stress" OR

Table 1

Study Selection Criteria

Inclusion	Exclusion
1. The study design is a randomised controlled trial	1. The intervention is not specifically targeting mental health (e.g., diet, weight loss)
2. The intervention is a mobile mental health intervention	2. The intervention is an adjunctive treatment (i.e., the intervention is given in addition to treatment as usual)
3. The study includes a validated instrument assessing a mental health related outcome (depression,	3. The intervention is a text-message only intervention

anxiety, stress, well-being, quality of life)	
	4. The paper is not peer-reviewed (e.g., preprints, white papers)
	5. The study is qualitative or a review
	6. The paper includes secondary analysis

Note. Trials that conducted an information session, intake meeting or one session of psychoeducation prior to the delivery of the app intervention are included. Secondary analyses can be included, but only if they add effect analyses not reported in the original RCT.

Data Screening

Title and abstract screening were conducted using the software tool Covidence (Covidence systematic review software, 2025). Covidence facilitates efficient data screening and data extraction for systematic literature reviews, with its intuitive interface, which enhances both speed and accuracy, and a simple navigation system (Harrison et al., 2020; Leenaars et al., 2024). Additionally, in this study, Covidence was used for removing duplicates, full-text review, and monitoring decisions during all stages of screening (Kraiss et al., 2024). Furthermore, two master psychology students were trained for the title and abstract screening, beginning with a pilot on circa 10% of records to assess interrater reliability using Cohen's kappa. If kappa was at least 0.7, they independently continued screening the rest. The obtained kappa in the first iteration was 0.72, indicating adequate agreement between both raters to proceed with the screening process, and in total, 750 records were screened. The two screeners were instructed to be inclusive when deciding whether to exclude records.

Therefore, if there was any doubt, they were instructed to include the record for full-text screening.

Full-texts of selected abstracts were then reviewed by three other trained psychology master's students, and to validate eligibility decisions and calibrate discrepancies, 10% of these full-texts were checked by two experienced supervisors. Additionally, full-text reviewers would apply the inclusion and exclusion criteria, as outlined in Table 1, in a standardised order. They had reviewed each paper based on the same sequence of criteria and stopped further review when a paper was excluded due to a specific criterion. Moreover, full-text reviewers were advised to be conservative with exclusions as well. If there was uncertainty, they would mark the full text as 'uncertain' and discuss further handling with two experienced supervisors.

Data Extraction

The data extraction process started from December 2024 to May 2025. Data was primarily extracted by four psychology master's students. Initially, these four data extractors underwent a training stage. This training took place during a team meeting where two experienced supervisors explained the general procedure for extracting data and contacting authors in case of missing information. The training session included the extraction of data from one example paper. After the initial training, the four data extractors, along with two experienced supervisors, extracted data from three papers that have been included after full-text review. The results of this pilot data extraction were compared, and inconsistencies were discussed with all data extractors to ensure calibration. At any point during the extraction process, the data extractors were able to ask the experienced supervisors for feedback.

Furthermore, the data was extracted using a data extraction template in Microsoft Excel (Kraiss et al., 2024). A separate Excel file was created for each included paper. The information that was extracted comprised:

1. *Study characteristics*: first author's name; publication year; country; time to follow-up (in weeks); type of design (RCT, crossover trial, cluster RCT); Population description (e.g., college students with elevated levels of depression); Clinical level: is the sample a nonclinical, subclinical or clinical group; Condition: type of clinical condition envisioned to be treated by the intervention (e.g., depression); Comorbidity: whether the sample has a comorbidity; Measures: the instruments that were used to assess mental health outcomes (e.g., Patient Health Questionnaire-9).
2. *Sample characteristics*: Mean age; Percentage female participants; Total number of participants in the trial and per arm; Number of participants dropped out at each assessment; Mean scores for each mental health outcome at baseline and follow-up assessments; Standard deviation for each mental health outcome at baseline and follow-up assessments.
3. *Intervention characteristics*: Intervention type: Primary therapeutic approach the intervention is based on (e.g., ACT, CBT); Length: Duration of the intervention (in weeks); Personalization: If there is an element of personalization in the intervention (0/1); Gamification: If there is an element of gamification in the intervention (0/1); Guidance: programs that include some level of professional support or interaction as part of the therapeutic process (0/1); Peer-support: Features that enable interaction with peers, such as forums or chat groups (0/1); Integration of other technologies: Incorporating data and functionalities from additional devices (e.g., wearables or VR) or external systems (e.g., calendar, weather information) (0/1); Chatbot: If the

intervention included chatbot elements or any other type of large language model was integrated into the intervention (0/1).

Data Analysis

All data analysis was conducted with RStudio with version R 4.5.0. First, the data was cleaned by removing missing data from the dataset. Then, the data was filtered to only use studies that include mindfulness as an intervention type. Additionally, descriptive statistics of the included studies were calculated.

Within-Group Effect Sizes

From the outcome measures of each article, standard deviations (SD) and means (M) are converted into standardised mean differences (SMD). This addresses the variability of depression and anxiety outcome scores by taking into account the trial, group, and time point within the results of each article. SMDs were computed by dividing the standard deviation of the change scores by the difference in the baseline and follow-up mean outcome scores. Hedges' *g*, which accounts for small sample bias and yields a more precise estimate of standardised mean differences of within-group designs, was employed to assess effect sizes (Harrer et al., n.d.-a). These results can then be analysed through a between-group meta-analysis.

Between-Group Meta-Analysis

To evaluate and compare the effectiveness of the four intervention groups in this study, a hierarchical meta-analysis was conducted. The analysis included between-group comparisons among Mindfulness only, Mindfulness with Guidance, Mindfulness with Personalisation, and Mindfulness with both Guidance and Personalisation. The group variable was dummy-coded, with the Mindfulness only group serving as the reference category. All reported effect sizes for other conditions represent comparisons against this baseline. To

account for variability over time, time (in weeks) was included as a random slope. Additionally, random intercepts were specified for each study to account for the nested structure of observations within trials. Additionally, to quantify the effect sizes, Hedges' *g*, standard error (*SE*), a 95% interval (95% CI) and *p* values were calculated for each condition regarding their outcomes on anxiety and depression.

Hedges' *g* was used to estimate effect sizes, and a correlation coefficient of 0.5 was chosen to more accurately approximate these effect sizes, for this is frequently used in the literature, and each arm of a study has its own effect size (Choi et al., 2024; Jefsen et al., 2022; Talebi et al., 2021). Consequently, the standardised nature of this measure facilitates comparison across different studies when calculating within-study effect sizes (Harrer et al., n.d.-a). To investigate the effects of covariates, two additional calculations were made, including the covariates: age, female, clinical, and comorbidity. For visualisation, separate forest plots were generated for anxiety and depression. Finally, hypotheses regarding whether adding guidance, personalisation, or both resulted in significantly greater improvements compared to mindfulness alone were evaluated.

Covariate Effects

Finally, to find out whether there would be any change in the effect of the four main conditions, an additional analysis was conducted, including several variables that have been identified in the literature as affecting symptoms of anxiety and depression. These variables were age, the percentage of females, the percentage of clinical populations, and the percentage of comorbidity (Arango-Dávila & Rincón-Hoyos, 2018; Brown & Roose, 2011; Lewinsohn et al., 1998; Werntz et al., 2023). Clinical populations refer to participants diagnosed by a healthcare professional (e.g., diagnosis of a depressive disorder), while comorbid populations are those in which participants have another condition alongside depression or anxiety (e.g., depressed patients being treated for cancer).

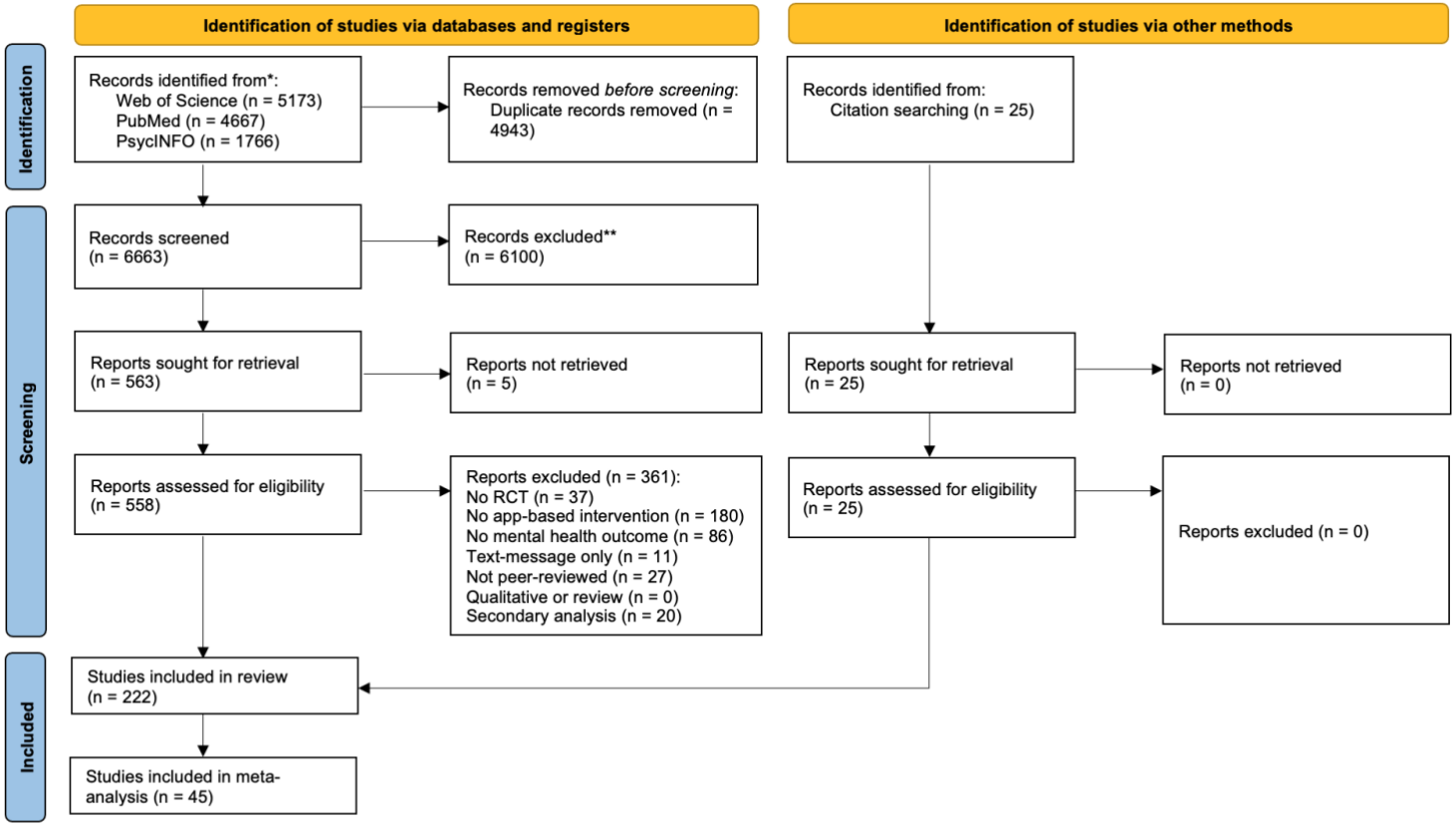
Results

Study Characteristics

A total of 45 articles were included in the analysis, selected as a subset from the original pool of 222 articles identified during the systematic review process, as these focused on mobile apps in which mindfulness was the primary intervention technique (see Figure 3). Some articles addressed both anxiety and depression symptoms, thereby belonging to multiple categories. The total number of participants, including intervention and control groups, across all the included 45 studies comprised 13.530 with a total of 102 arms. Furthermore, the included studies predominantly originate from the following countries: the United States (21), China (7), and the United Kingdom (4). All studies are randomised controlled trials (RCTs), whereby 5 employed a delayed waitlist RCT design, and 2 utilised cluster RCTs. Regarding measurement instruments, the most frequently used questionnaires to assess anxiety and depression were the Generalised Anxiety Disorder 7 (GAD-7) in 12 articles and the Patient Health Questionnaire 9 (PHQ-9) in 8 articles. The most commonly used control groups were waitlist controls (12), placebo app controls (8), and care-as-usual controls (8). For more detailed descriptive statistics, see Table 2.

Figure 3

PRISMA Flow Diagram



*Consider, if feasible to do so, reporting the number of records identified from each database or register searched (rather than the total number across all databases/registers).
**If automation tools were used, indicate how many records were excluded by a human and how many were excluded by automation tools.

Source: Page MJ, et al. BMJ 2021;372:n71. doi: 10.1136/bmj.n71.

Table 2

Descriptive Statistics of the Different Conditions Analysed in This Study

	Number of Studies (*N*)	**Number of participants (*n*)**	**Number of Arms (*k*)**	**Age *M* (*SD*)**	**Female (%)**	**Clinical (%)**	**Subclinical (%)**	**Comorbid (%)**	**Mean Follow-up Duration in Weeks *M* (*SD*)**	**Attrition Rate (%)**
Total Mindfulness Intervention Studies	45	8406	57	35.1 (12.0)	76.5	5.4	36.3	7.2	8.2 (7.4)	22.5
Measuring Anxiety										
Mindfulness only	22	6531	48	35.7 (9.2)	79.0	0.9	32.5	8.8	8.5 (8.6)	26.8
Mindfulness with guidance	10	933	21	37.3 (15.9)	78.0	10.3	48.7	0.0	8.0 (4.5)	22.3

Mindfulness with personalisation	5	234	10	23.5 (10.3)	75.3	14.8	29.6	14.8	6.4 (6.2)	11.8
Mindfulness with guidance and personalisation	5	239	10	37.9 (10.7)	63.6	33.3	44.4	0.0	7.9 (4.1)	15.5
Measuring Depression										
Mindfulness only	21	6492	45	36.2 (9.0)	80.1	0.0	30.3	9.2	8.6 (8.8)	26.3
Mindfulness with guidance	9	744	18	45.4 (14.6)	69.5	0.0	48.6	11.4	9.9 (5.6)	20.6
Mindfulness with personalisation	4	206	8	20.3 (8.6)	67.4	0.0	47.1	0.0	7.7 (7.5)	9.6

Mindfulness with guidance and personalisation	6	309	11	35.4 (11.8)	66.4	33.3	33.3	0.0	6.1 (3.3)	15.5

Note. Clinical = diagnosed by a healthcare professional, Subclinical = populations screened for elevated levels of symptoms, Comorbid = populations have another condition alongside depression or anxiety, Mean Follow-up Duration in Weeks = time until post or follow-up measurement, Attrition Rate = percentage of participants who dropped out of a study before its completion.

Meta-Analysis

When running the regression, by making the mindfulness-only condition the dummy variable and the covariate the type of mindfulness intervention, effect sizes and other relevant study outcomes were calculated (see Table 3). The effect sizes are all negative, indicating a reduction in symptoms of anxiety and depression compared to the reference group (Cohen, 2013; De Pablo et al., 2021; Hedges, 2007). Moreover, Hedges' $g = 0.2$ can be considered a small effect size, Hedges' $g = 0.5$ a medium effect size, and Hedges' $g = 0.8$ a large effect size (Cohen, 2013; Hedges, 2007).

The analysis revealed that the mindfulness-only condition significantly reduced depressive symptoms, with a small effect size ($g = -.223$, $p = .002$). Furthermore, adding guidance ($g = -.355$, $p = .015$) and both guidance and personalisation ($g = -.351$, $p = .019$), show significant medium effect sizes. However, adding personalisation alone ($g = -.114$, $p = .485$) did not account for statistically significant improvements beyond mindfulness alone for depression. These findings suggest that there is an additional benefit of incorporating guidance or both guidance and personalisation for reducing depression symptoms. Accordingly, the alternative hypotheses H1 and H2 can be accepted for depression, and the alternative hypothesis H3, can be rejected.

With regard to anxiety, the mindfulness only condition also demonstrated a significant reduction in symptoms ($g = -.251$, $p < .000$). When either guidance ($g = -.184$, $p = .053$) or personalisation ($g = -.057$, $p = .622$) were added, no significant effects were observed. Notably, only the combination of guidance and personalisation ($g = -.262$, $p = .023$) yielded a significant improvement compared to mindfulness alone. This indicates that while guidance or personalisation on their own do not enhance anxiety outcomes significantly, their combined use can provide additional benefits. Therefore, regarding anxiety symptoms, the

alternative hypothesis H1 can be accepted, and the alternative hypotheses H2 and H3 can be rejected.

Table 3

Meta-analysis

Analysis	Depressive Symptoms				Anxiety Symptoms			
	g	***SE***	**95% CI**	***p***	***g***	***SE***	**95% CI**	***p***
Mindfulness only (intercept)	-.223	.072	[-.364, -.083]	.002**	-.251	.053	[-.355, -.147]	<.000***
Mindfulness with Guidance	-.355	.147	[-.642, -.068]	.015*	-.184	.095	[-.370, .003]	.053
Mindfulness with Personalisation	-.114	.163	[-.433, .205]	.485	-.057	.115	[-.282, .168]	.622
Mindfulness with Guidance and Personalisation	-.351	.149	[-.643, -.058]	.019*	-.262	.116	[-.488, -.035]	.023*

Note. Mindfulness Only = Reference Group; Time = Random Effect; Total Articles = 45; *g* = Hedges' *g*; *SE* = Standard Error; CI = Confidence Interval. *$p < .05$. **$p < .01$. ***$p<.001$.

In Table 4, covariates including age, the percentage of females, the percentage of the clinical population, and the percentage of comorbidity are adjusted for, as they can affect the results and help determine whether observed effects are genuine or a result of confounding factors. The previously significant effects on depression became non-significant when these covariates were included. The *p*-values rose beyond .05, losing statistical significance. Mindfulness-only interventions were the only exception to this, with a *p*-value of .017. This is greater than before, yet still below .05. Moreover, after the variables were added, all effects for anxiety symptoms lost significance as well, since their *p*-values rose over .05. This indicates that the perceived effectiveness of interventions may be greatly influenced by confounding variables, and it is crucial to account for these factors to achieve more precise estimates.

Table 4

Meta-analysis Adjusted for Covariate Effects

Analysis	Depressive Symptoms				Anxiety Symptoms			
	g	***SE***	**95% CI**	***p***	***g***	***SE***	**95% CI**	***p***
Mindfulness only (intercept)	-1.148	.481	[-2.091, -.205]	.017*	-.115	.348	[-.797, .568]	.742
Mindfulness with Guidance	-.273	.185	[-.635, .088]	.139	-.216	.134	[-.480, .047]	.107
Mindfulness with Personalisation	.078	.232	[-.376, .532]	.736	-.102	.163	[-.422, .218]	.532
Mindfulness with Guidance and Personalisation	-.171	.193	[-.550, .208]	.376	-.194	.163	[-.514, .125]	.234

Note. Mindfulness Only = Reference Group; Time = Random Effect; Total Articles = 45; *g* = Hedges' *g*; *SE* = Standard Error; CI = Confidence Interval. *$p < .05$. **$p < .01$. ***$p<.001$.

In order to gain a comprehensive understanding of how individual studies contribute to the overall findings, eight forest plots for anxiety and depression with each condition were generated (see Figures 4-11 in Appendix A). These plots illustrate the effect sizes (Hedges' *g*) and 95% confidence intervals for each individual study incorporated into the meta-analysis (Harrer et al., n.d.-b). Most studies show small negative effect sizes, reflecting a general trend toward reduced depression and anxiety symptoms following the interventions. Regarding the depression outcome, in the mindfulness-only plot, only three studies and one study in the combined guidance and personalisation plot have confidence intervals crossing the null line. In the guidance or personalisation plots, none cross this line. For anxiety, two studies in the mindfulness-only plot and one in the combined guidance and personalisation plot cross the null line, while the guidance or personalisation plots individually show zero crossings. This pattern underscores the generally robust, statistically significant effects of the mobile mindfulness conditions, with only a small number of individual trials showing non-significant within-group changes (Harrer et al., n.d.-b).

Discussion

This study explored whether adding guidance, personalisation, or both to mobile mindfulness interventions improves their effectiveness on depression and anxiety, compared to interventions without them. Four types of intervention conditions were analysed: mindfulness only, mindfulness with guidance, mindfulness with personalisation, and mindfulness with both guidance and personalisation. The meta-analysis indicated that mindfulness-only interventions were effective in reducing both depression and anxiety. Additionally, incorporating the combination of guidance and personalisation led to significant improvements over mindfulness alone for both anxiety and depression symptoms. Notably, a significant positive effect on depression was observed when just guidance was included in the

mobile mindfulness intervention as well. However, adding just personalisation did not result in positive effects for depression or anxiety.

The findings regarding the effect of guidance on anxiety symptoms and personalisation on both anxiety and depression symptoms alone reflect the mixed evidence in the literature (Hornstein et al., 2023; Matthews & Rhodes-Maquaire, 2024; Roquet & Sas, 2018). Contrary to Hypotheses 2 and 3, neither guidance nor personalisation produced statistically significant improvements on their own, except for the effect of guidance on depression. This can be explained by looking at the specific therapy needs of the different disorders. Individuals with depressive symptoms may need more structure and guidance than individuals with symptoms of anxiety (Miller et al., 2020; Shafran et al., 2024). On the other hand, more attention towards anxieties may be increasing anxiety symptoms instead of decreasing them (White et al., 2009).

Furthermore, the concept of personalisation was broadly operationalised in this study, encompassing a wide range of tailored features. It is possible that focusing on specific types of personalisation, such as AI-driven feedback or real-time adaptive interventions, may have revealed more pronounced effects. For example, targeted personalisation strategies that provide immediate, relevant feedback could enhance user engagement, motivation, and perceived support, thereby leading to greater therapeutic benefit (Nwanna et al., 2025). Additionally, an aspect that is often overlooked is the distinction between proximal and distal outcomes. Proximal outcomes are immediate outcomes after an intervention, while distal outcomes refer to long-term outcomes. The current study primarily examined follow-up measures, which reflect distal effects rather than proximal effects. However, it is observed that proximal outcomes influence the effectiveness of personalisation on depression and anxiety as well (Stamatis et al., 2024).

Noteworthy is that when guidance and personalisation were combined, there was a significant reduction in anxiety and depression symptoms, supporting Hypothesis 1. This suggests that the integration of both elements can produce greater therapeutic benefits, potentially by increasing user engagement and adherence (Parsons et al., 2019; Balaskas et al., 2022). While guidance appeared effective in reducing depression symptoms, its effect on anxiety outcomes was not statistically significant. However, it may be somewhat premature to conclude definitively that guidance has no impact on anxiety, especially when the observed effect was in the expected direction and the *p*-value was just shy of significance. A more nuanced interpretation may be warranted, as these trends could indicate a potentially meaningful effect that might emerge more clearly with larger samples or refined methodologies. Indeed, the efficacy of personalised apps in addressing both anxiety and depression symptoms remains a critical area for future research (Robberegt et al., 2022). Similarly, future research could elucidate the precise role that guidance plays in anxiety outcomes (Edge et al., 2023).

Limitations and Future Directions

Several limitations should be acknowledged. Firstly, the number of studies for the personalised and combined intervention conditions was limited, which could impact statistical power. Secondly, a considerable amount of missing data from the articles may have led to exclusion during analysis, which could introduce selection bias. Additionally, the effect sizes in this analysis were calculated using Hedges' *g* with a correction factor of 0.5, as opposed to 0.7. This choice may slightly underestimate the true effect sizes, particularly in studies with small sample sizes, potentially resulting in marginally lower estimates.

Although guidance appeared effective in reducing depressive symptoms, it did not significantly improve anxiety outcomes. Future research should explore why guidance might be more beneficial for depression than for anxiety. In addition, the synergistic effect observed

when combining guidance and personalisation suggests that these features may reinforce each other. Upcoming studies should investigate this interaction more thoroughly. Importantly, when covariates such as age, clinical status, and comorbidity were included in the analysis, most effects lost statistical significance. This indicates that the app's effectiveness may be moderated by individual differences. Therefore, future studies should examine the effect of moderators and mediators to better understand for whom and under what conditions these features are most effective.

In conclusion, this study adds to the growing evidence that mobile mindfulness interventions are effective in reducing depression and anxiety symptoms. While guidance did not demonstrate benefits for anxiety symptoms, and personalisation alone did not demonstrate significant benefits for both anxiety and depression symptoms, their combined implementation showed an enhancement in anxiety and depression outcomes. These findings imply that including guided and personalised support features may boost the efficacy of mindfulness apps, just as adding guidance alone may benefit the reduction of depression symptoms.

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Appendix A

Forest Plots

Figure 4

Forest Plot: Depression-Mindfulness

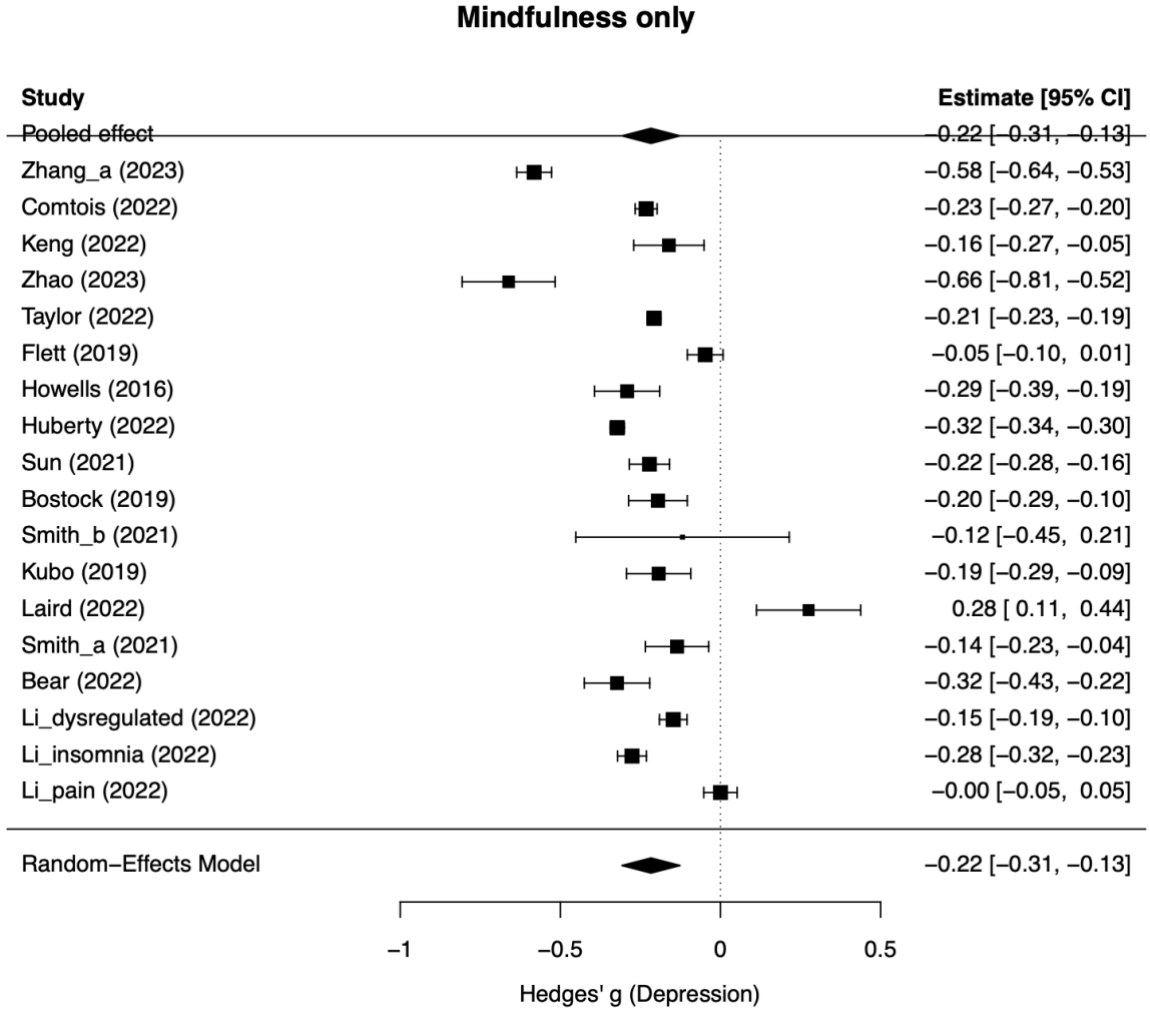


Figure 5

Forest Plot: Depression-Mindfulness with Guidance

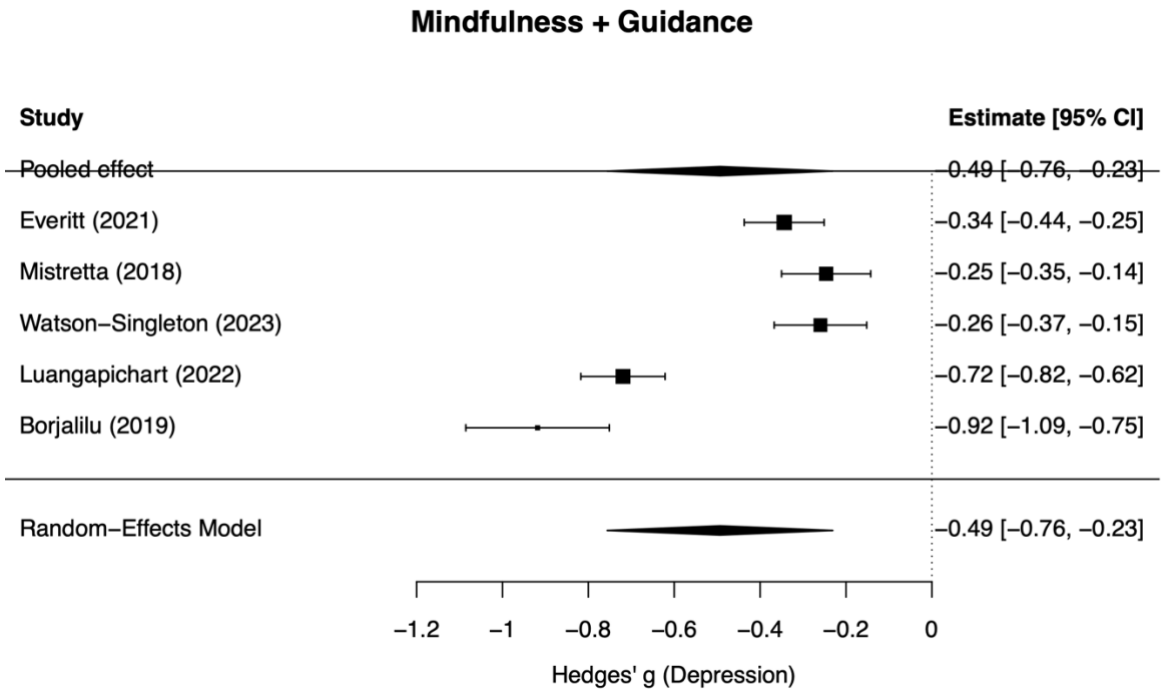


Figure 6

Forest Plot: Depression-Mindfulness with Personalisation

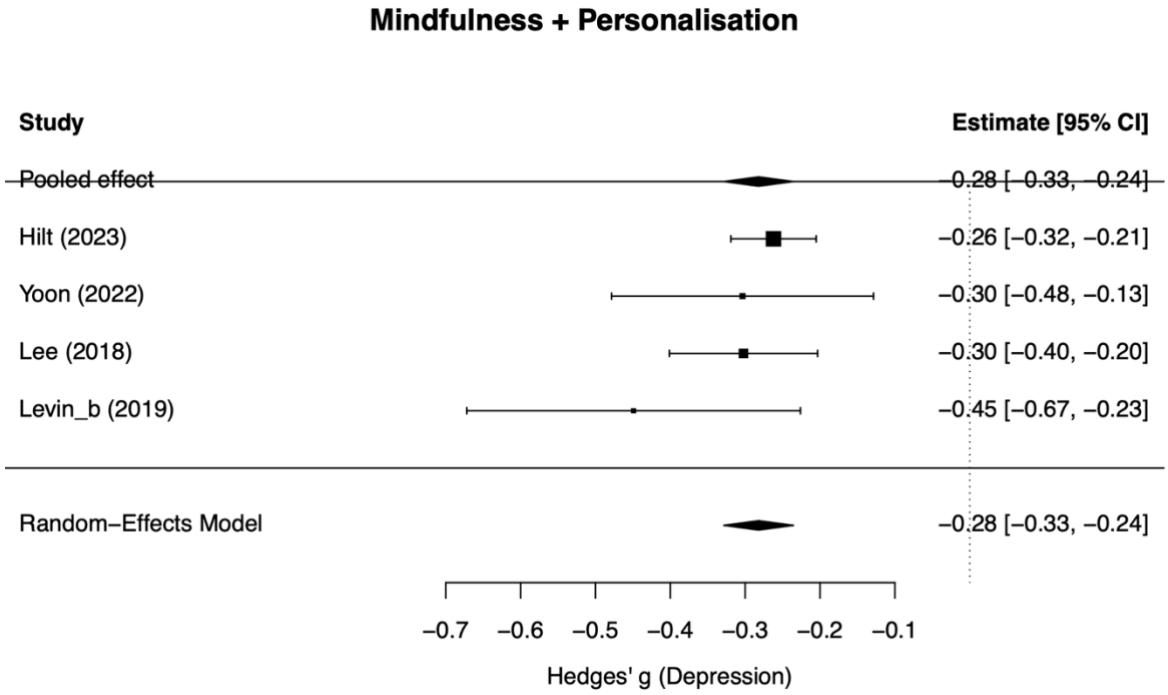


Figure 7

Forest Plot: Depression-Mindfulness with Guidance and Personalisation

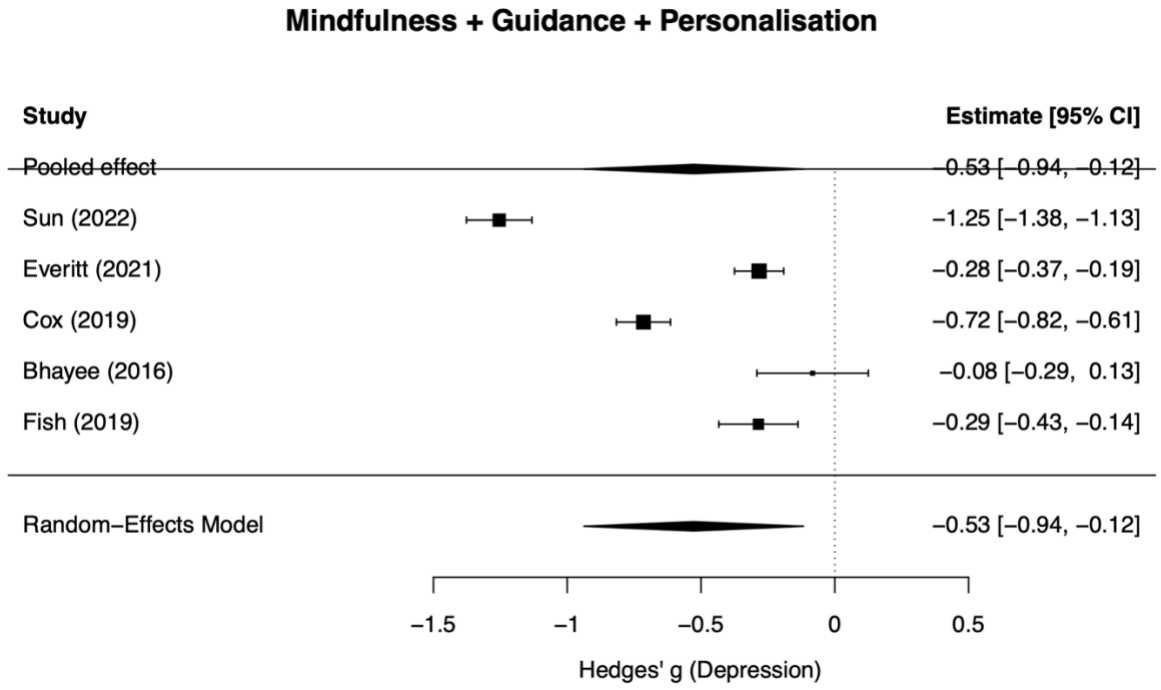


Figure 8

Forest Plot: Anxiety-Mindfulness

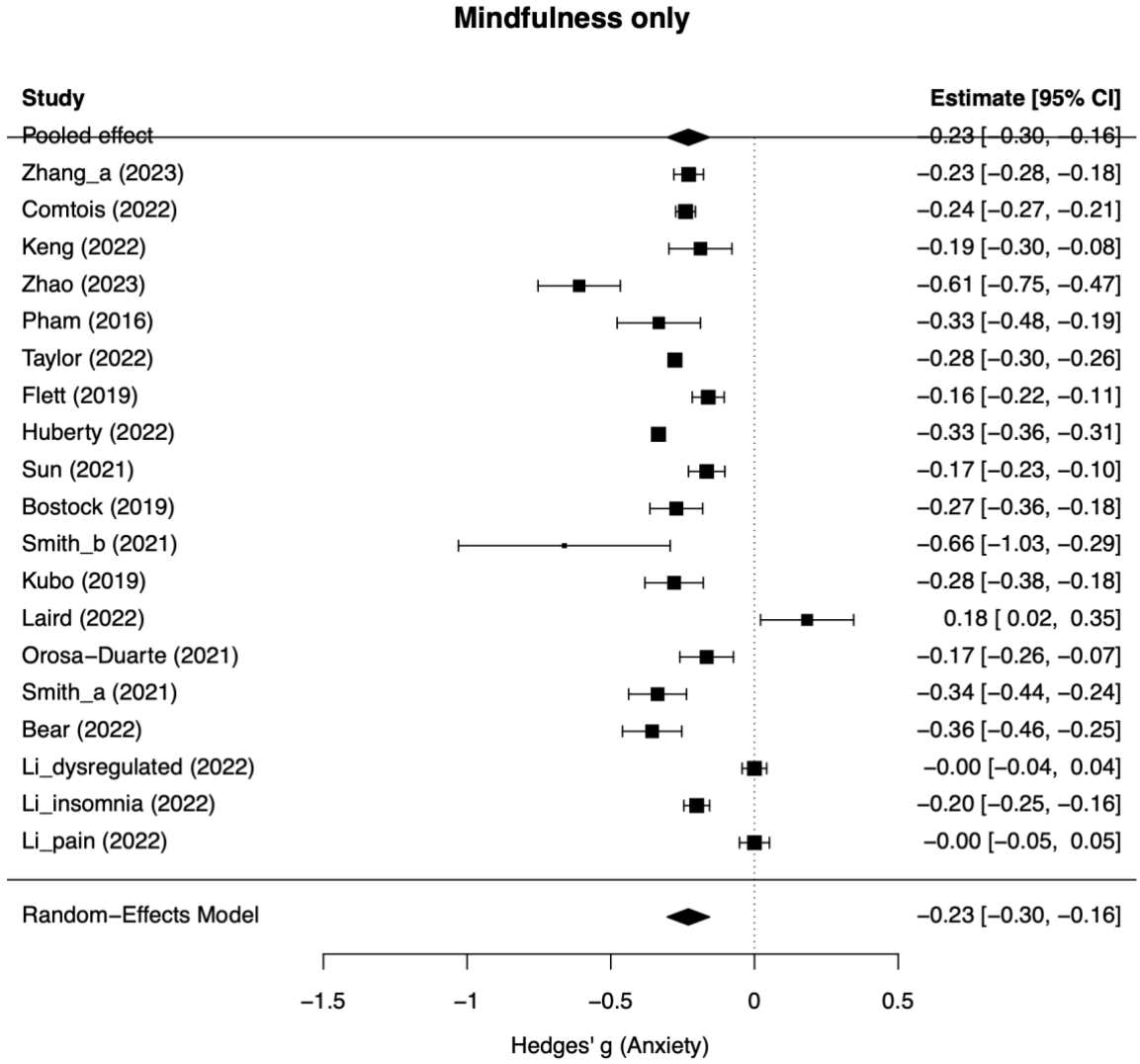


Figure 9

Forest Plot: Anxiety-Mindfulness with Guidance

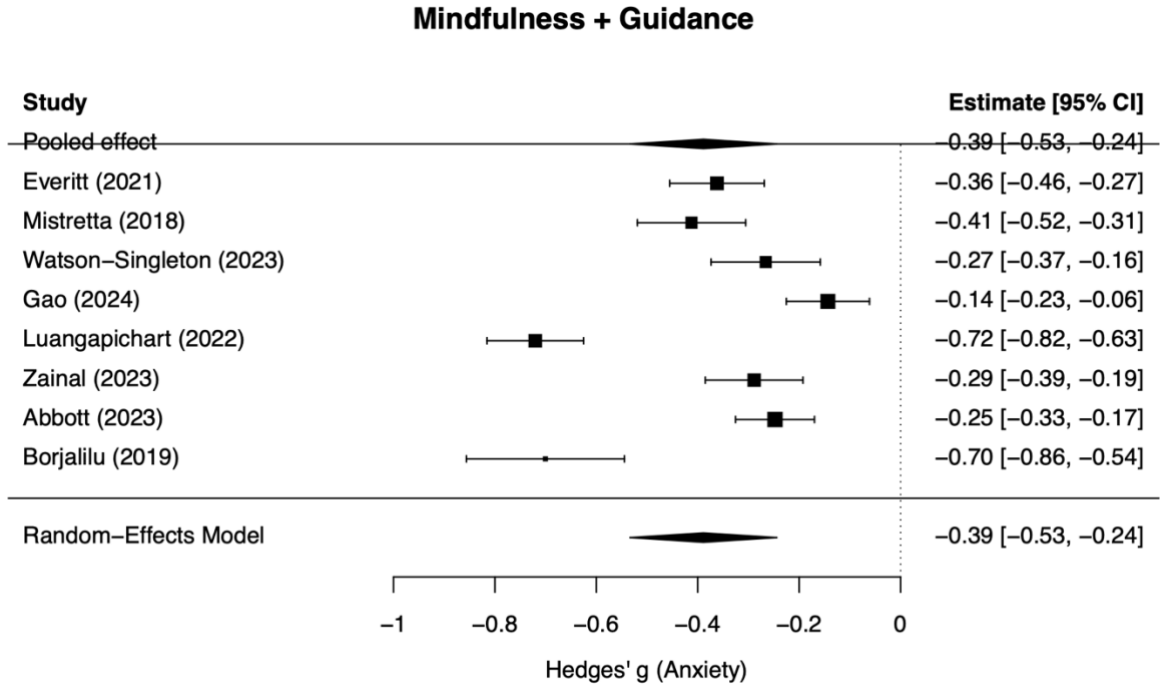


Figure 10

Forest Plot: Anxiety-Mindfulness with Personalisation

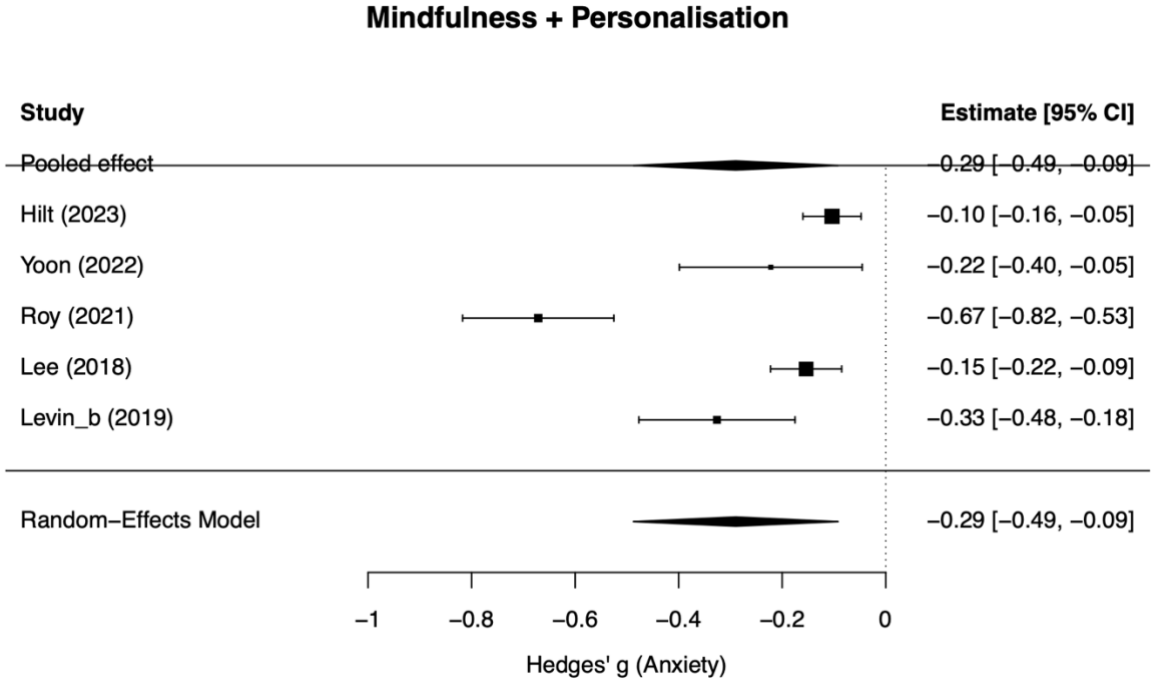
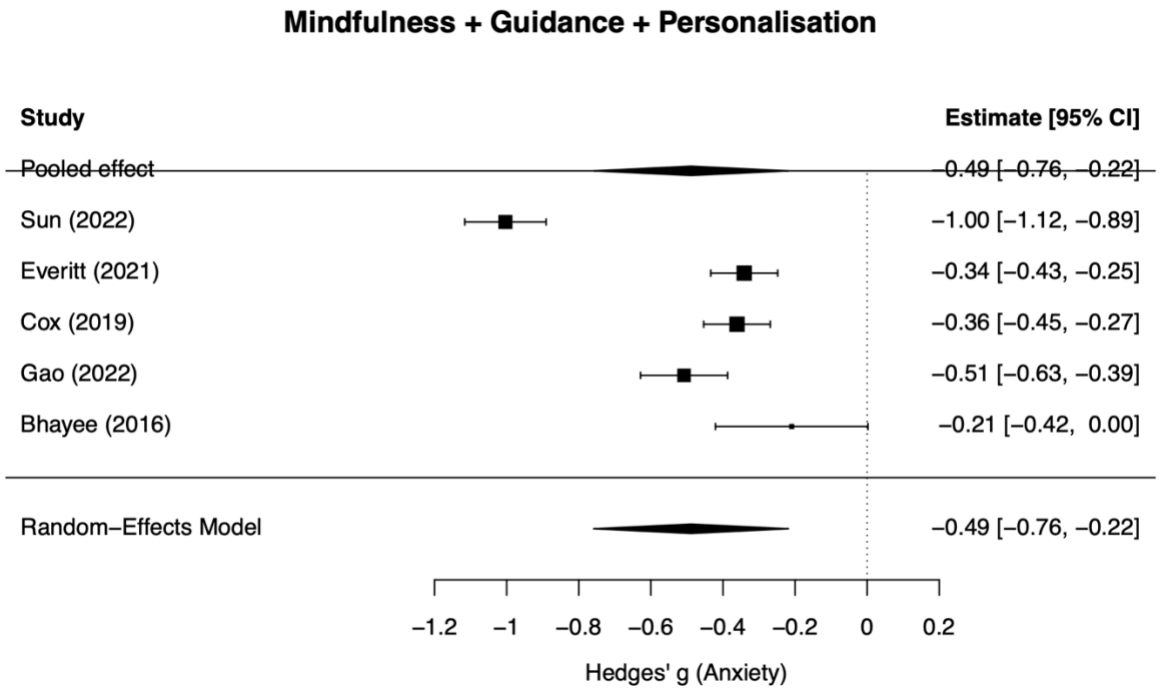


Figure 11

Forest Plot: Anxiety-Mindfulness with Guidance and Personalisation



Appendix B

Artificial Intelligence (AI) statement

During the preparation of this work the author used ChatGPT in order to brainstorm and receive feedback on the structure or formulation of the text. After using this tool, the author reviewed and edited the content as needed and takes full responsibility for the content of the work.