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Review article

Mobile app-based psychological interventions for depression and anxiety in primary care: A systematic review and meta-analysis

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ABSTRACT

Objective: This systematic review and meta-analysis evaluated the effectiveness of mobile app-based psychological interventions in reducing distress (depressive and anxiety symptoms) and improving quality of life among adults in primary care (PC).

Methods: We included randomized controlled trials (RCTs) involving adults with depression and/or anxiety identified through searches of PsycINFO, PubMed, Embase, and the Cochrane Library from database inception to April 11, 2025. Standardized mean differences (SMDs) and relative risks (RRs) were pooled using fixed- and random-effects models. Study quality was assessed using the Cochrane Risk-of-Bias 2 tool.

Results: Eleven RCTs ($N = 2915$) met inclusion criteria, contributing 15 comparisons to the meta-analysis ($N = 2588$; intervention vs. treatment as usual). Pooled analyses showed a significant reduction in overall distress (SMD = −0.44; 95% CI −0.68 to −0.21, $p < 0.001$) and a moderate decrease in depressive symptoms (SMD = −0.53, 95% CI −0.81 to −0.24, $p < 0.001$). Limited evidence from four comparisons showed no significant effect on anxiety (SMD = −0.25, 95% CI −0.68 to 0.18, $p = 0.26$). A small but significant improvement in quality of life was found (SMD = 0.16, 95% CI 0.06 to 0.25, $p = 0.001$). Participants using apps were more likely to drop out at post-treatment than controls (RR = 1.45, 95% CI 1.18 to 1.79, $p < 0.001$).

Conclusions: Mobile app-based interventions appear to reduce distress and depressive symptoms and modestly improve quality of life in PC, although no significant effects were observed for anxiety. These findings support the potential role of app-based interventions as accessible tools within primary care. However, the limited and heterogeneous reporting of follow-up assessments restricts conclusions about the durability of these effects over time. Higher dropout rates also highlight the need to improve adherence strategies.

1. Introduction

Psychological disorders remain a major public health concern, affecting over one billion individuals worldwide [1]. Among these, depressive and anxiety disorders are the most prevalent and disabling, jointly representing the leading contributors to years lived with disability globally [2]. Both are associated with impaired quality of life, social and occupational functioning, and physical health, as well as substantial economic costs estimated at roughly one trillion U.S. dollars per year [3,4]. Their frequent comorbidity further amplifies severity and chronicity, posing major challenges for prevention and treatment [5]. Despite their burden, access to evidence-based psychological care remains limited. For instance, in high-income countries, fewer than one in four individuals with depression receive minimally adequate treatment, and in low- and middle-income countries, most affected individuals receive none [6,7]. Barriers such as workforce shortages, long waiting lists, high treatment costs, stigma, and logistical difficulties contribute to this gap [8]. Consequently, many individuals do not receive adequate psychological treatment for depression and anxiety [1,9].

Primary care (PC), the first point of contact for most adults with

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emotional distress, plays a critical role in addressing these challenges. PC providers are responsible for the early detection and management of common mental disorders. However, they often face time constraints, heavy caseloads, and limited mental health training. These factors frequently lead to underdiagnosis, undertreatment, and reliance on medication [10]. Integrating psychological care into PC is a key strategy to reduce treatment gaps [11], yet traditional face-to-face psychotherapy is difficult to scale. These limitations have spurred growing interest in digital solutions that expand access to evidence-based interventions.

Mobile app-based psychological interventions have emerged as scalable, low-cost tools for improving accessibility and continuity of mental health care [12]. By delivering evidence-based content directly to users' smartphones, they can overcome barriers related to workforce shortages, stigma, and geographical and economic constraints. Mobile apps can provide flexible, guided or unguided interventions that reach individuals who might otherwise not seek care [13,14]. Meta-analytic evidence supports their efficacy for depression and anxiety, especially when guidance or engagement strategies are incorporated [15–17]. Their potential is particularly relevant in PC. In this setting, digital tools can serve as first-line or adjunctive treatments for mild to moderate conditions, enhance continuity of support, reduce clinician workload, and promote universal access [18]. Importantly, mobile app-based interventions may offer greater scalability than other digital mental health formats. Once developed, they can be disseminated widely at low marginal cost, require minimal clinician involvement, and be integrated into routine PC workflows without substantially increasing service capacity demands [19,20].

Although digital mental health interventions have been extensively studied [21,22], mobile apps represent a distinct category within this broader field, characterized by delivery through smartphones and by their capacity for continuous interaction in users' everyday contexts. They offer constant accessibility, integration into daily routines, and real-time monitoring and feedback [23]. Furthermore, compared with web-based programs, they enable continuous, context-sensitive engagement [24]. While several reviews have specifically examined mobile app-based psychological interventions, they have largely focused on general populations and heterogeneous settings, with limited attention to their effectiveness when implemented within PC systems. These reviews have shown small-to-moderate effects on depression and anxiety, with substantial heterogeneity across designs, contents, and levels of guidance (e.g., [15,16,25]).

Despite this growing evidence base, few studies have examined the effectiveness of mobile apps in PC, where patient characteristics and treatment delivery differ markedly from the controlled conditions of efficacy trials typically conducted in academic or research settings. As a result, the effectiveness of these interventions when implemented in routine PC may differ from that observed in controlled research settings. Given the rapid expansion of mobile health technologies and their potential to transform the delivery of mental health care, a focused synthesis of evidence on mobile apps in PC is needed. Understanding their effectiveness is essential to inform implementation, optimize adherence, and improve mental health outcomes for PC patients.

Therefore, the aim of this study is to conduct a systematic review and meta-analysis of mobile apps for depression and anxiety in adult PC populations. Specifically, it (1) evaluates their effectiveness compared with control conditions on psychological distress, depressive and anxiety symptoms, and quality of life; and (2) analyzes treatment dropout rates as an indicator of adherence. By synthesizing current findings, this review seeks to clarify the potential role of mobile apps in improving mental health care delivery within PC systems.

2. Methods

2.1. Identification and selection of trials

We conducted a systematic review and meta-analysis following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines [26]. The review protocol was previously registered at the Open Science Framework (https://osf.io/rs4fc/overview?view_only=d9269ab7c4b34cd6b700d8d713b9c036). Four electronic databases were systematically searched: PubMed, Embase, PsycINFO, and The Cochrane Library, covering the period from database inception, spanning several decades, until April 11, 2025. In addition, a hand-search of reference lists of comprehensive systematic reviews was conducted to identify additional eligible studies [15,16,25,27]. The detailed search strings used for each database are provided in Supplement 1. Studies were eligible for inclusion if they met the following criteria:

1. Participants. Adults (≥18 years) presenting symptoms of depression and/or anxiety, identified through a validated diagnostic interview or by scoring above a validated cutoff on standardized scales. Although obsessive–compulsive disorder (OCD) and posttraumatic stress disorder (PTSD) are classified separately in the DSM-5-TR, studies including these populations were also eligible due to their high comorbidity and shared transdiagnostic mechanisms related to anxiety and emotional dysregulation [28–30].
2. Interventions. Smartphone apps specifically designed to deliver psychological interventions targeting depression and/or anxiety. Studies using other mobile modalities (e.g., text messaging, SMS, email, or chat-based platforms) were excluded to maintain a clear conceptual focus on interventions in which the smartphone app constituted the primary, self-contained platform for delivering structured therapeutic content, rather than a communication channel alone. These modalities typically deliver brief or fragmented content and lack the capacity to support multi-component, interactive psychological treatments (e.g., psychoeducation, skills training, self-monitoring, and feedback) that characterize mobile app–based interventions and have been examined as a distinct class in the existing digital mental health literature (e.g., [15,16,31]). Blended interventions combining app use with structured face-to-face psychotherapy as a core treatment component were excluded to avoid conflating the effects of the app with those of formal psychological treatment. All included trials were conducted within routine primary care settings, where participants generally retained unrestricted access to usual care. Interventions including guidance from a supporter were eligible when such support was adjunctive and limited in intensity, and when the primary content and mechanisms of change were delivered through the app. Brief contacts with clinicians or other supporters aimed at facilitating engagement with the app (e.g., goal setting, encouragement, or assigning app-based activities) were considered acceptable, provided that the mobile app remained the primary therapeutic component of the intervention.
3. Design. Randomized controlled trials (RCTs) with any comparator type, including waitlist, treatment as usual (TAU), inactive controls, or active interventions (e.g., alternative psychological or pharmacological treatments).
4. Outcomes. Studies reporting at least one depression or anxiety outcome measure.

2.2. Study selection and data extraction

All retrieved references were imported into Rayyan (Qatar Computing Research Institute, Doha, Qatar) to identify and remove duplicates. Two researchers (A-GR and A-DG) independently screened titles and abstracts, followed by full-text assessment according to the eligibility criteria. Any disagreements were resolved through discussion until consensus was reached.

Data were independently extracted by two researchers using a predesigned standardized extraction form. The main summary table, included in the manuscript, presents the key study and intervention characteristics, including: study reference, country, sample, number of

participants per group, dropout rates at post-treatment (n, %), mean age, percentage of female participants, app name and operating system, guidance modality, treatment period (weeks), number of modules, and follow-up duration (weeks after post-treatment).

Additionally, two supplementary tables (Tables S2.1 and S2.2) were prepared. Table S2.1 summarizes procedural aspects of the included trials, including enrollment procedures, compensation, and characteristics of the human support provided alongside the app (i.e., training and supervision of supporters, support plan, and type of supporter involved, e.g., nurses or psychologists). Table S2.2 compiles engagement metrics, including measures of use (e.g., sessions completed, logins, time per module), corresponding quantitative indicators, and reported associations with clinical outcomes.

Finally, data used for the meta-analytic computations were extracted for each study arm, including the number of participants at pre- and post-treatment, the number of dropouts, and the means and standard deviations at pre- and post-treatment for all relevant clinical outcomes (depression, anxiety, and quality of life). When means and standard deviations were not available, alternative summary statistics (e.g., change scores, mean differences, or *p*-values) were extracted and, when possible, transformed into equivalent effect size metrics following standard meta-analytic procedures.

2.3. Risk of bias assessment

Methodological quality was assessed using the Cochrane Risk of Bias 2 Tool (RoB 2) [32]. This instrument systematically assesses five key domains of potential bias in randomized studies: the randomization process, deviations from intended interventions, missing outcome data, measurement of outcomes, and selection of the reported results. Each domain was rated as low risk, some concerns, or high risk. An overall risk of bias judgment was also assigned to each study based on these domain-level ratings. The risk of bias assessment was independently conducted by two reviewers (A-GR and A-DG), each of whom coded the studies using the RoB 2 criteria. Any discrepancies in judgments were addressed through discussion until a consensus was reached.

2.4. Assessment of the certainty of the evidence

The certainty of the evidence for each outcome was appraised using the GRADE framework [33,34]. Two reviewers (A-GR and A-DG) conducted the assessment independently, examining the five core GRADE domains: risk of bias, inconsistency, indirectness, imprecision, and publication bias. Certainty was downgraded when concerns were identified in any of these domains. Final ratings were categorized as high, moderate, low, or very low, in accordance with GRADE guidance. Disagreements were resolved through discussion until a consensus was reached.

2.5. Data synthesis, statistical analysis, and meta-analysis

Effect sizes were calculated for all studies reporting sufficient data on depressive and/or anxiety symptoms using validated self-report or clinician-rated scales. Following prior meta-analytic work (e.g., [35]), general measures (PHQ-9, BDI-II, GAD-7, HADS) were prioritized over disorder-specific instruments; when unavailable, the most conceptually related scale was extracted. If multiple eligible outcomes existed for the same construct within a study, separate Cohen's d values were computed and entered as distinct comparisons, denoted in forest plots with lowercase letters (e.g., [36]). Overall distress (depression and anxiety), expressed as means and SDs, was the primary outcome. Secondary outcomes included quality of life (means and SDs) and dropout rates at post-treatment (proportions; analyzed as risk ratios, RRs). Dropout at post-treatment was operationalized as non-completion of the post-intervention assessment.

When pre–post differences were not reported, mean change scores were computed, and missing SDs of the difference were estimated following Yagiz et al. [37]. Of the 11 eligible RCTs, 9 ($N = 2588$) were included in the quantitative synthesis; two comparing the app to another active intervention rather than TAU were excluded from pooled analyses for comparability.

Given variation in measurement instruments, results were expressed as standardized mean differences (Cohen's d), with negative values indicating symptom reduction and positive values reflecting improved quality of life. Conventional thresholds of 0.20, 0.50, and 0.80 denoted small, moderate, and large effects [38]. In addition to the combined distress outcome, subgroup analyses were conducted to examine depressive and anxiety symptoms separately. Heterogeneity was quantified using I^2 and interpreted as low (≈25%), moderate (≈50%), or high (≈75%; [39]). Random-effects models (DerSimonian–Laird) were applied when $I^2 \geq 75\%$; otherwise, fixed-effects models (inverse-variance) were used. Dropout rates were compared using RRs with 95% CIs.

Publication bias was assessed via Begg's test, Egger's regression, and visual inspection of funnel plots ($p < 0.05$ indicating possible bias), which are provided in Supplement 3. When present, the trim-and-fill method estimated its impact. Leave-one-out analyses examined the influence of individual studies on pooled estimates. All analyses were conducted in Stata v14.0 (StataCorp) using the metan package, with $\alpha = 0.05$ and 95% CIs reported throughout.

3. Results

3.1. Selection and inclusion of studies

The database search yielded a total of 15,544 records: 916 from PsycINFO, 5479 from The Cochrane Library, 2259 from PubMed, and 6890 from Embase. Thirty-one additional studies were identified by hand-searching the reference lists of included studies. After removing 4011 duplicates, 11,535 records were screened based on titles and abstracts. Of these, 11,235 were excluded for not meeting the eligibility criteria. The remaining 300 articles were assessed in full text. Following this detailed review, 290 studies were excluded, leaving 10 articles that met all inclusion criteria. One of the included articles reported on two separate RCTs, resulting in a total of 11 trials being included in the final analysis. A PRISMA flowchart illustrating the study selection process is presented in Fig. 1.

3.2. Key characteristics of included studies

Key characteristics of included studies are shown in Table 1. Eleven randomized controlled trials published between 2016 and 2025 were included, comprising 2915 participants across six countries (United States, Brazil, Peru, Finland, Iran, and Australia). All studies were conducted in PC or comparable general medical settings. One trial with university students was included because recruitment occurred through a nationwide primary-level health system, and two studies focused on veterans with posttraumatic stress disorder were also implemented in PC. Among the postpartum depression (PPD) trials, one took place in PC and another in a setting sharing key PC characteristics such as accessibility, continuity, and integration with community health services. One additional trial targeting primarily adults was also included because, although the intervention also targeted adolescents, most participants were adults (only 6 of 130 were under 18 years old). Sample sizes ranged from 20 to 880 participants, with mean ages between 25 and 60 years, and female representation varied widely (5%–100%), according to the target population. Most studies enrolled adults with clinically relevant depressive or anxiety symptoms, and two included participants with comorbid medical conditions [40]. Nine trials compared a digital intervention with treatment as usual, and two compared active app-based conditions [45,48]. All interventions were mobile app–based psychological treatments grounded in behavioral activation or CBT, with most trials including some form of guidance or human support ($n =$

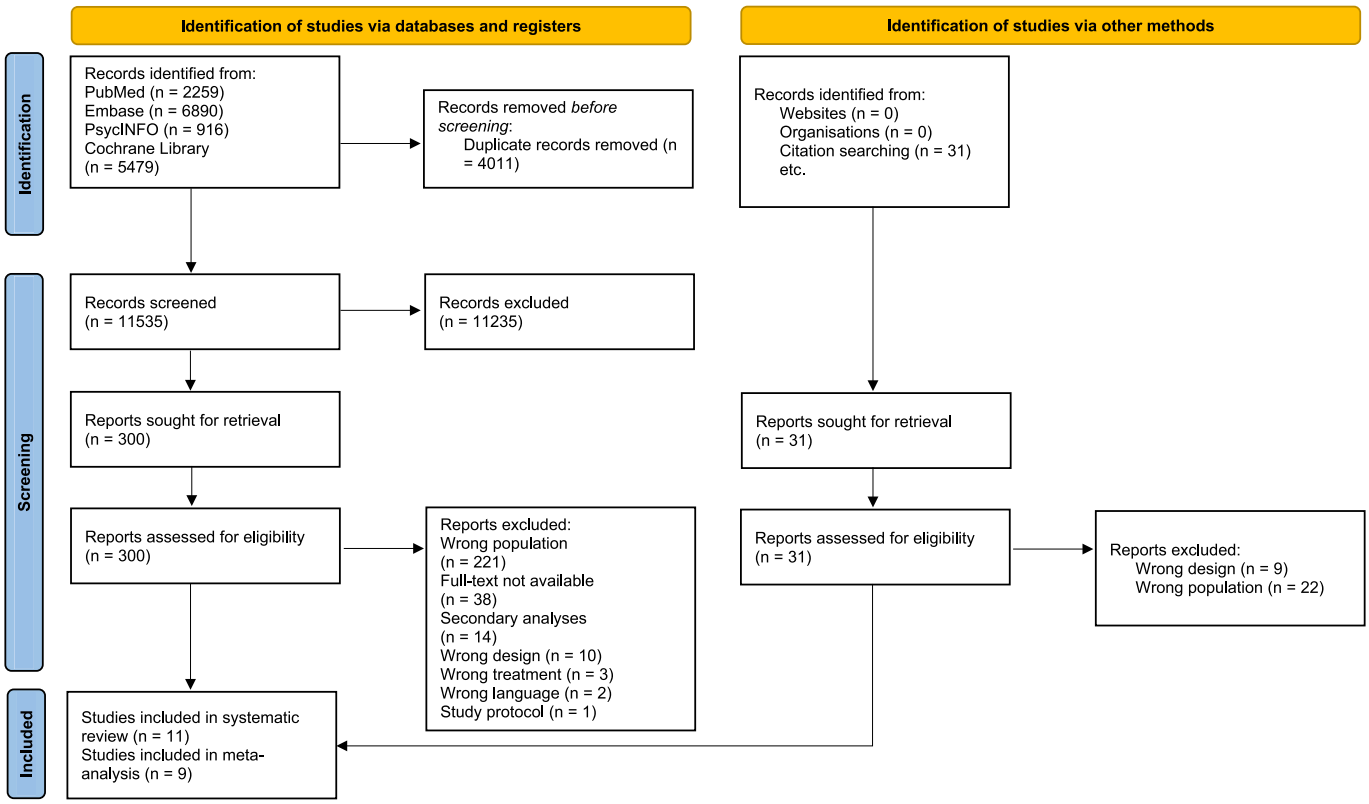

Fig. 1. PRISMA 2020 flow diagram of study selection process.

8). In two studies, this support consisted of brief clinician contacts aimed at facilitating engagement with the app (e.g., setting symptom reduction goals or assigning app-based activities), rather than delivering a full course of psychotherapy [36,45]. Interventions were delivered over six to sixteen weeks, most commonly lasting eight weeks ($n = 7$). Attrition at post-treatment ranged from 2% to 30%. The weighted dropout rate for intervention arms (mobile apps) was estimated to be 14% (95% CI: 12.4 to 15.7) and for TAU arms 8.9% (95% CI: 7.5 to 10.4). When reported, additional procedural characteristics and engagement-related usage metrics (e.g., logins, sessions completed, time spent) are summarized descriptively in Tables S2.1 and S2.2.

3.3. Risk of bias

Overall, the risk of bias across the 11 included RCTs was low. Seven studies were rated as low risk in all five RoB 2 domains. Three studies were judged as having some concerns, mainly related to the randomization process (Domain 1) and selection of the reported result (Domain 5). Only one study [45] was rated as high risk of bias, primarily due to concerns regarding the measurement of outcomes. No systematic concerns were observed in the domains related to deviations from intended interventions or missing outcome data. Detailed results of the risk of bias assessment are presented in Supplement 4.

3.4. Certainty of evidence

Based on the GRADE assessment, the certainty of evidence supporting the effect of mobile psychological apps on *distress* and *depression* was rated as moderate, due to substantial unexplained heterogeneity across studies. The certainty of evidence for the effect on *anxiety* was judged to be low, reflecting both high heterogeneity and imprecision arising from wide confidence intervals and a relatively small total sample. In contrast, the certainty of evidence for improvements in *quality of life* and for differences in *dropout rates* was assessed as high, as these outcomes demonstrated consistent findings, adequate precision, and no concerns regarding risk of bias, indirectness, or publication bias (see Supplement 5).

3.5. Meta-analyses

A series of meta-analyses were conducted to examine the effects of mobile apps on overall distress, depression, anxiety, quality of life, and dropout rates (see Fig. 2).

3.6. Meta-analysis on overall distress levels (depression and anxiety)

Substantial heterogeneity was observed ($I^2 = 89.4\%$, $Q = 142.17$, $\tau^2 = 0.17$, $p < 0.001$); therefore, a random-effects model was applied. No risk of publication bias was observed according to the results of Egger's test (coefficient = −1.99, $p = 0.275$). The pooled effect size showed a significant reduction in distress (SMD = −0.444; 95% CI −0.675 to −0.213, $p < 0.001$). The sensitivity analysis revealed that, when excluding one study at a time, pooled effects ranged from −0.306 to −0.493, indicating that no single study dominated the results.

Subgroup analyses indicated a significant and moderate reduction in depression (SMD = −0.526, 95% CI −0.810 to −0.242, $p < 0.001$), whereas no significant effect was observed for anxiety (SMD = −0.250, 95% CI −0.680 to 0.181, $p = 0.256$).

3.7. Meta-analysis on quality of life

Low heterogeneity was detected ($I^2 = 20.1\%$, $Q = 5.01$, $\tau^2 = 0.0033$, $p = 0.286$); therefore, a fixed-effects model was applied. No risk of publication bias was observed according to the results of Egger's test (coefficient = −1.33, $p = 0.478$). The pooled effect indicated a small but significant improvement in quality of life (SMD = 0.157, 95% CI 0.062 to 0.251, $p = 0.001$).

Table 1
Key characteristics of included studies and their interventions.

Study	Country	Sample	N (per group)	Dropout at post-treatment, n (%)	Mean age (years)	% Female	App name (Operative system)	Guidance	Treatment period (weeks)	Modules (number)	Study outcomes	Follow-up (weeks post-treatment)
Araya et al. [40] (a)	Brazil	Adults with depression and hypertension/ diabetes	BA: 440 TAU: 440	BA: 49 (11.1) TAU:41 (9.3)	56	0.87	CONEMO (Android)	Guided	6	18 (mini-sessions)	Depression (PHQ-9) QoL (EQ-5D-3L)	Yes (12)
Araya et al. [40] (b)	Peru	Adults with depression and hypertension/ diabetes	BA: 217 TAU: 215	BA: 12 (5.5) TAU: 10 (4.7)	60	0.82	CONEMO (Android)	Guided	6	18 (mini-sessions)	Depression (PHQ-9) QoL (EQ-5D-3L)	Yes (12)
Dahne et al. [41]	USA	Adults with depression	BA Mobile app: 24 CBT Mobile app: 19 TAU: 9	BA Mobile app: 2 (8.3) CBT Mobile app: 1 (5.3) TAU: 0 (0)	44	0.85	Moodivate (iOS)	Unguided	8	NR/NA	Depression (BDI-II)	No
Dahne et al. [42]	USA	Adults with depression	BA app: 226 BA+ EHR: 234 TAU: 226	BA app: 53 (23.5) BA+ EHR: 45 (19.2) TAU: 19 (8.4)	45	0.76	Moodivate (Both)	Unguided	12	NR/NA	Depression (BDI-II)	No
Graham et al. [43]	USA	Adults with depression/ anxiety	CBT: 74 TAU: 72	CBT: 7 (9.5) TAU: 10 (13.9)	42	0.82	IntelliCare (Both)	Guided	8	NR/NA	Depression (PHQ-9) Anxiety (GAD-7)	No
Jannati et al. [44]	Iran	Mothers with PPD	CBT: 39 TAU: 39	CBT: 1 (2.6) TAU: 2 (5.1)	28	1	Happy Mom (NR)	Unguided	8	8	Depression (EPDS)	No
Possemato et al. [45]	USA	War veterans with PTSD	CBT (guided): 10 CBT (unguided): 10	CBT (guided): 0 (0) CBT (unguided): 2 (20)	42	0.05	PTSD Coach (Both)	Guided	8	4	Depression (PHQ-9) PTSD (PCL-5) QoL (WHO-QOL BREF)	No
Possemato et al. [36]	USA	War veterans with PTSD	CBT: 115 TAU: 119	CBT: 7 (6.1) TAU: 15 (12.6)	51	0.1	PTSD Coach (Both)	Guided	8	4	Depression (PHQ-9) PTSD (CAPS-5; PCL-5) QoL (WHO-QOL BREF)	Yes (8 and 16)
Raevuori et al. [46]	Finland	University students with depression	CBT: 63 TAU: 61	CBT: 19 (30.2) TAU: 13 (21.3)	25	0.73	Meru Health Program (Both)	Guided	8	8	Depression (PHQ-9) Anxiety (GAD-7)	Yes (12 and 24)
Sawyer et al. [47]	Australia	Mothers with PPD	CBT: 72 TAU: 61	CBT: 12 (16.7) TAU: 3 (4.9)	32	1	eMums Plus (Both)	Guided	16	NR/NA	Depression (EPDS)	Yes (16)
Stiles-Shields et al. [48]	USA	Adults with depression/ anxiety	BA: 65 Psychoeducation app: 65	BA: 10 (15.4) Psychoeducation app: 13 (20)	32	0.82	Vira (Both)	Guided	8	NR/NA	Depression (PHQ-9) Anxiety (GAD-7) QoL (PedsQL)	Yes (4)

Note. BA: BA: behavioral activation; **BDI-II:** Beck Depression Inventory–II; **CAPS-5:** Clinician-Administered PTSD Scale for DSM-5; CBT: cognitive-behavioral therapy; Cut: cut-off (using a validated self-reported scale); diag: diagnosis (using a validated structured or semistructured diagnostic interview); **EHR:** electronic health record (system used to inform primary care providers about participants' engagement with the digital intervention); **EPDS:** Edinburgh Postnatal Depression Scale; **EQ-5D-5L:** EuroQol 5-Dimension 5-Level; **GAD-7:** Generalized Anxiety Disorder–7; NR/NA: not reported/not applicable; **PCL-5:** PTSD Checklist for DSM-5; **PedsQL:** Pediatric Quality of Life Inventory; **PHQ-9:**Patient Health Questionnaire–9; PPD: postpartum depression; **PTSD:** posttraumatic stress disorder; **QoL:** quality of life; TAU: treatment as usual; USA: United States of America; **WHOQOL-BREF:** World Health Organization Quality of Life–BREF.

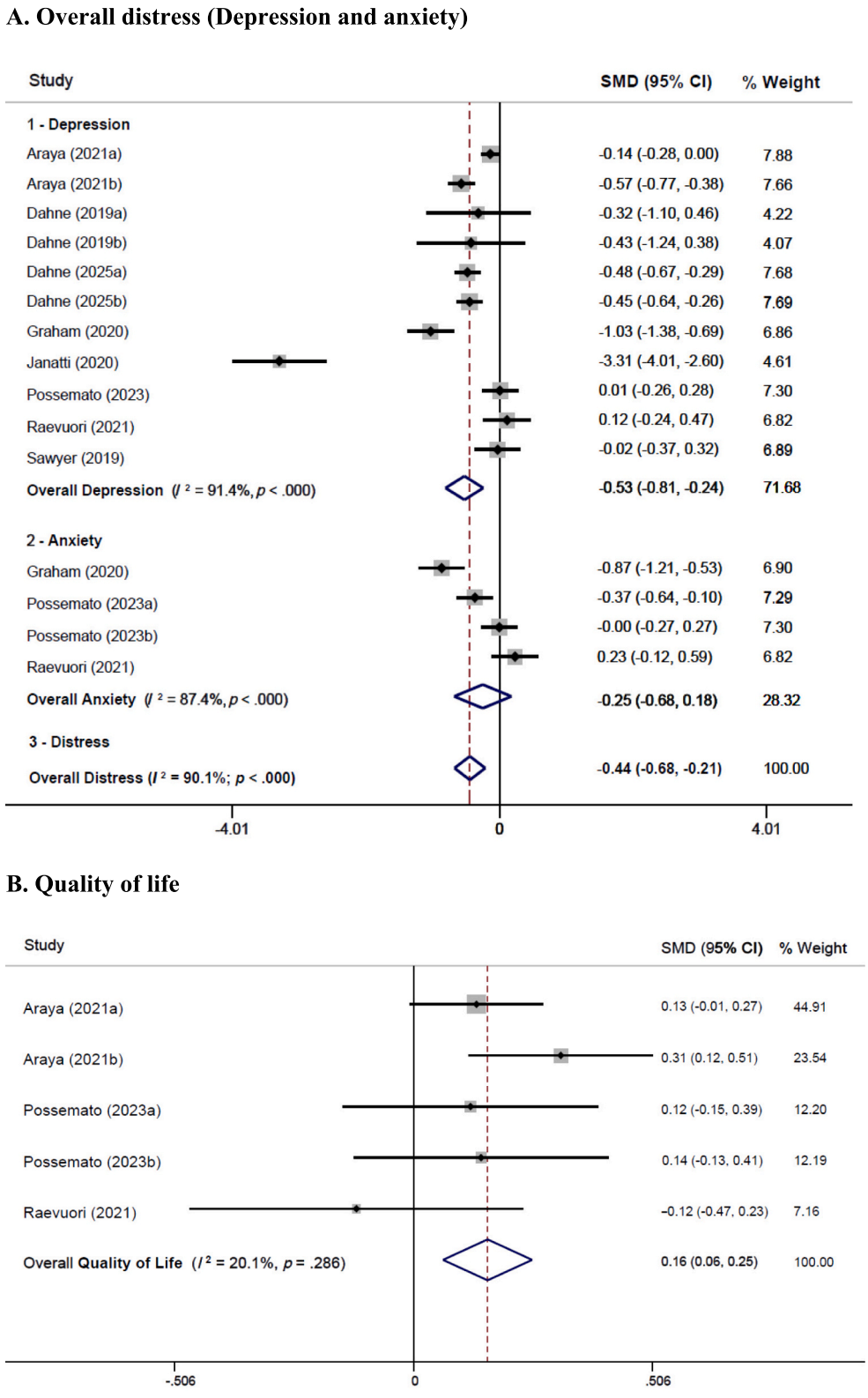

Fig. 2. Forest plots of treatment effects across outcomes. (A) Random-effects meta-analyses showing standardized mean differences (SMDs) and 95% confidence intervals for overall distress, depressive symptoms, and anxiety. Negative values indicate greater symptom reduction in intervention groups compared with controls. (B) Fixed-effects meta-analysis showing standardized mean differences (SMDs) and 95% confidence intervals for quality of life. Positive values indicate greater improvement in intervention groups compared with controls. (C) Fixed-effects meta-analysis of relative risks (RRs) and 95% confidence intervals comparing post-treatment dropout between intervention and control groups. Values greater than 1 indicate a higher likelihood of dropout among participants using psychological treatment apps.

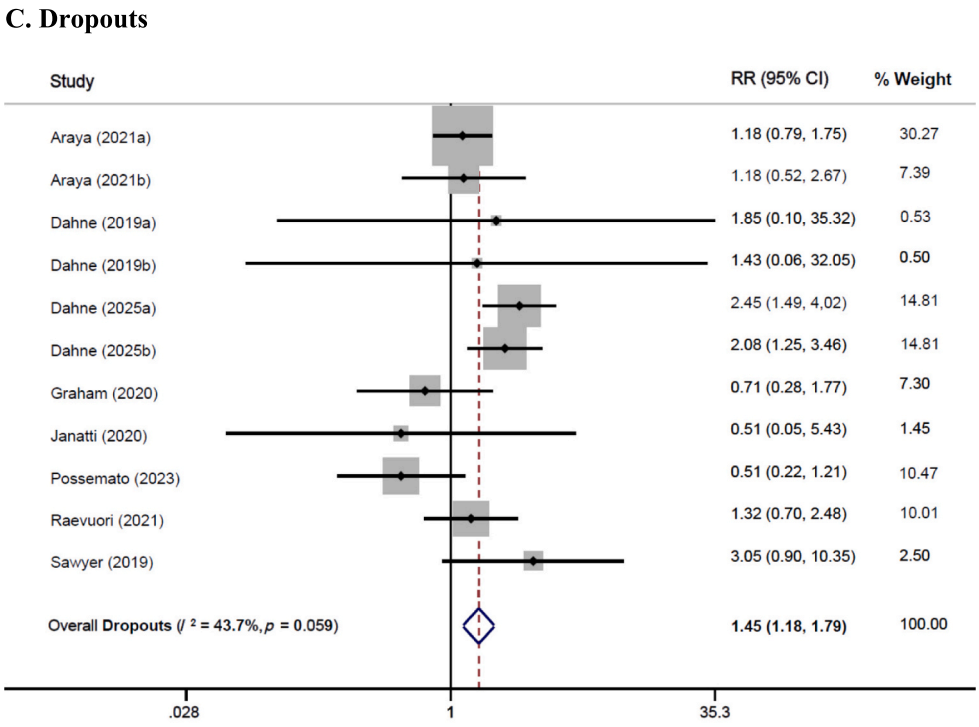

Fig. 2. (*continued*).

3.8. Meta-analysis on dropouts

Moderate heterogeneity was observed ($I^2 = 43.7\%$, $Q = 17.78$, $p = 0.059$); therefore, a fixed-effects model was employed. No publication bias was detected according to Egger's test (coefficient = −1.31, $p = 0.106$). The pooled relative risk indicated that, at post-treatment, participants in the experimental groups were more likely to drop out than controls (RR 1.451, 95% CI 1.179 to 1.787, $p < 0.001$).

3.9. Follow-up outcomes (narrative synthesis)

Six of the eleven included trials reported follow-up assessments beyond post-treatment, with follow-up periods ranging from 4 to 24 weeks after treatment completion. Due to substantial heterogeneity in follow-up timing, outcome measures, and reporting formats, quantitative synthesis was not feasible. Narrative examination indicated mixed evidence regarding durability of effects. Two trials conducted in São Paulo and Lima reported significantly greater odds of depressive symptom improvement in the digital intervention groups at 12-week follow-up. In contrast, other studies showed improvements in depressive, anxiety, or PTSD symptoms over time in both intervention and control groups, with generally similar trajectories and small or inconsistent between-group differences at follow-up. Quality-of-life outcomes, when assessed, showed modest changes without clear intervention-specific advantages. Overall, findings suggest that while short-term benefits may be maintained in some contexts, evidence regarding longer-term superiority of app-based interventions over usual care remains heterogeneous. A detailed overview of follow-up outcomes by study, including follow-up duration and outcome measures, is provided in Supplement 6.

4. Discussion

4.1. Summary of main findings

This meta-analysis addresses a gap in the literature by specifically evaluating the effectiveness of mobile app–based psychological interventions for depression and anxiety in PC. While several previous reviews have examined app-based interventions in general populations—encompassing community, university, and mental health care settings [16,17,27]—none have focused exclusively on PC, where these disorders are highly prevalent and often comorbid. Given that PC is the main entry point for mental health treatment worldwide, examining the real-world effectiveness of psychological apps in this context is crucial to inform scalable and accessible care models. The meta-analysis found that mobile app–based interventions were associated with significant reductions in overall distress, specifically in depressive symptoms, along with small, yet significant, improvements in quality of life. However, no significant effects were observed for anxiety. In line with the GRADE assessment, the certainty of evidence supporting effects on distress and depression was moderate, whereas the evidence for anxiety was rated as low, underscoring the need for larger and more consistent trials targeting this symptom domain. This lack of effect may be partly explained by the limited number of trials targeting anxiety, with half of the comparisons focusing on PTSD, which could have reduced statistical power to detect an effect. Therefore, future studies including a larger number of anxiety-focused interventions may yet reveal significant effects of mobile apps on anxiety symptoms. Also, participants using apps were more likely to drop out at post-treatment than those receiving TAU. These findings suggest that mobile app–based interventions may offer a scalable and accessible approach for managing common mental disorders in PC, although challenges remain in sustaining engagement and evaluating longer-term effects. Most included trials were judged to be at low risk of bias, supporting the robustness of these findings while acknowledging some variability in study quality.

4.2. Comparison with previous research and interpretation

The results align with prior meta-analyses of mobile app–based interventions, which typically report small-to-moderate symptom reductions across diverse settings [16,17,25,27,49]. The somewhat more modest effects observed in the present review may reflect the challenges of implementing app-based interventions in real-world clinical settings, where patient populations are more heterogeneous and levels of support

and engagement may vary compared with more controlled research environments. However, by focusing specifically on adults recruited from PC, this review extends the evidence to populations with high comorbidity, variable symptom severity, and limited access to specialized care. Moreover, the magnitude of effects is consistent with brief, low-intensity psychological interventions delivered in PC [50,51], supporting the clinical utility of app-based approaches in these settings. Stronger effects for depression likely reflect the predominance of BA-based interventions, which directly target behavioral avoidance but may be less suited to anxiety mechanisms. Additionally, anxiety was usually assessed as a secondary outcome, reducing statistical power to detect changes. Differences in guidance, usability, and engagement may further account for variability. In this regard, guidance is especially relevant in PC, where providing ongoing support can be logistically challenging; however, comparisons between guided and unguided formats were limited due to the small number of unguided trials ($n = 3$). Consequently, future studies should address this gap, as unguided interventions may offer a scalable and cost-effective option for individuals with mild-to-moderate symptoms [52,53]. The heterogeneity observed across trials may also reflect differences in how app-based interventions are implemented within PC settings. Factors such as the degree of integration into routine clinical workflows, the extent to which interventions are tailored to the needs and characteristics of PC patients, the type and level of human support provided, and strategies used to promote patient engagement may influence treatment uptake and outcomes [13,54]. Future research examining these contextual and implementation-related factors may help optimize the effectiveness of mobile app-based interventions in real-world PC.

Furthermore, given the high comorbidity of depression and anxiety, transdiagnostic approaches targeting shared mechanisms (e.g., neuroticism) may be particularly suitable for PC [29]. A recent review found small-to-moderate improvements in emotional symptoms using transdiagnostic app-based interventions [49]. Because most interventions included here were BA-based and designed primarily for depression, future work should test explicitly transdiagnostic apps to better address comorbidity and broaden applicability in PC.

Although the relative risk of dropout was higher in intervention groups, the absolute difference was small. Nonetheless, adherence remains a challenge in digital mental health [55], and PC-specific factors such as competing demands and comorbidities may further hinder retention [54]. Beyond adherence, engagement—how participants interact with the app—is a key determinant of outcomes. Importantly, persuasive design features and varying levels of guidance have been linked to improved engagement and effectiveness [17]. In addition, more attention to therapist behaviors in guided interventions, such as empathy, encouragement, and personalized feedback, may also contribute to enhancing outcomes [56]. Although engagement was not a predefined outcome in this review, descriptive analyses summarized commonly reported usage metrics (e.g., logins, sessions completed, time spent) and their associations with clinical outcomes (see Supplement 2). These usage-based indicators provide useful descriptive information about how participants interact with app-based interventions during the active treatment period. Consistent with prior work, associations between engagement and symptom change were variable, with some evidence suggesting modest links for specific indicators such as module completion [57]. At the same time, these exploratory findings highlight the heterogeneity of engagement indicators and the limitations of coarse usage-based metrics, which provide limited insight into the quality of engagement or the extent to which therapeutic strategies are actively implemented in daily life [58]. Together, these observations underscore the need for more systematic, standardized, and conceptually refined measures of engagement to identify active components of mobile app–based interventions and inform design strategies that strengthen adherence and effectiveness [59]. In this context, emerging approaches such as ecological momentary assessments (EMAs), ecological momentary interventions (EMIs), and just-in-time adaptive interventions (JITAIs) may offer promising avenues to move beyond coarse usage-based indicators by helping to distinguish between passive app use and more active forms of engagement, such as the practice and application of therapeutic skills in daily life. By providing momentary, context-sensitive assessments and prompts, these approaches may contribute to a more nuanced understanding of how individuals engage with app-based interventions and how engagement relates to adherence and outcomes [60].

Finally, although six of the eleven trials reported follow-up assessments, substantial heterogeneity in follow-up timing and outcome reporting precluded quantitative synthesis. Narrative examination suggested mixed evidence regarding durability of effects, underscoring the need for future studies to implement standardized follow-up intervals and consistent outcome measures to enable more robust evaluation of longer-term impact.

4.3. Clinical implications

Mobile app–based psychological interventions may help reduce distress and depressive symptoms and provide small improvements in quality of life in PC, though effects on anxiety remain uncertain and dropout rates are comparatively higher. Taken together, these findings highlight both the promise and the challenges of implementing app-based interventions in real-world PC. By offering low-threshold and easily accessible support, such interventions may help overcome common PC barriers, including limited availability of mental health professionals and long waiting times. When integrated into stepped-care models, they could reduce burden on general practitioners and enhance continuity of care. These interventions also present distinct characteristics compared to broader digital mental health tools: they are designed for flexible, real-time use in daily life, enabling continuous access and integration of treatment strategies into patients' routines. They allow for greater personalization and adaptive feedback based on user behavior or symptom monitoring. These features may be particularly valuable in PC contexts characterized by high caseloads, comorbid physical conditions, and long waiting lists for specialized services. By facilitating rapid access to evidence-based psychological strategies, mobile apps can help bridge the gap between mental health needs and available resources. As such, this approach aligns with the WHO's call to strengthen mental health services within PC through innovative, integrated, and person-centered models [61].

4.4. Limitations

Several limitations should be acknowledged. First, the heterogeneous and limited reporting of follow-up assessments precluded reliable estimation of long-term effects, restricting quantitative conclusions to post-treatment outcomes. Second, the meta-analysis of quality of life was based on few comparisons, which may limit precision. Third, the number of anxiety measures was small, and both general and disorder-specific instruments were combined, which may have introduced additional variability. In addition, only English-language studies were included, and grey literature was not searched, which may introduce some risk of publication bias. Although no publication bias was detected in the analyses, its presence cannot be entirely ruled out. Despite these limitations, the consistency of findings and absence of significant publication bias suggest that the results provide a reasonably robust estimate of the short-term effects of psychological treatment apps in PC.

5. Conclusions

In summary, this meta-analysis provides evidence that mobile app–based psychological interventions are associated with reductions in distress and depressive symptoms and improvements in quality of life among adults with depression and anxiety in PC. These findings support the potential of app–based interventions as accessible and scalable

adjuncts to routine mental health care. However, no significant effects were observed for anxiety, and the limited number of studies evaluating this outcome highlights the need for further research. Future studies should place greater emphasis on anxiety and incorporate standardized follow-up assessments to determine whether benefits are maintained over time.

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CRediT authorship contribution statement

Alberto González-Robles: Writing – original draft, Supervision, Project administration, Methodology, Data curation, Conceptualization. **Verónica Romero-Ferreiro:** Writing – review & editing, Methodology, Formal analysis, Data curation. **Pablo Roca:** Writing – review & editing, Methodology, Formal analysis, Data curation. **Tíscar Rodríguez-Jiménez:** Writing – review & editing, Data curation. **Amanda Díaz-García:** Writing – review & editing, Supervision, Data curation.

Declaration of competing interest

The authors declare that they have no competing interests.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.genhosppsych.2026.03.008.

Data availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declaration of generative AI and AI-assisted technologies in the manuscript preparation process: Generative AI (ChatGPT, OpenAI) was used in a limited capacity to review the grammatical clarity and readability of the manuscript and the authors' responses to reviewers during the revision process. It was not used for literature review, data analysis, interpretation of results, or generation of scientific content. All conceptual, methodological, and interpretative aspects of the manuscript are the responsibility of the authors.

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