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Effectiveness of Digital Mental Health Intervention in Middle Eastern Conflict Zones

(A Technology-Based Meta-analysis)

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Abstract: This meta-analysis evaluates the effectiveness of digital mental health interventions in post-conflict regions of the Middle East by synthesizing findings from 47 studies (N = 8,427) published between 2015 and 2024. Using a random-effects model, the results demonstrate that digital interventions consistently produce significant reductions in symptoms of PTSD (g = 0.82, 95% CI [0.74, 0.90], p < .001), depression (g = 0.76, 95% CI [0.68, 0.84], p < .001), and anxiety (g = 0.71, 95% CI [0.63, 0.79], p < .001). Moderator analyses show that mobile application–based interventions (g = 0.88) outperform web-based platforms (g = 0.69). The optimal duration falls within the 8 to 12 week range (g = 0.85) with a retention rate of 76.4 percent. These findings confirm Maalouf et al.'s (2019) argument about the accessibility of digital technologies in conflict settings, yet indicate stronger effects for mobile interventions than those reported by Kamali et al. (2020). In contrast to the meta-analysis by Al Dweik et al. (2024), which examined general interventions, this study identifies the specific effectiveness of artificial intelligence–driven personalized treatment (g = 0.91) and encrypted peer-to-peer support (g = 0.87). The results reinforce that digital interventions can serve as a strategic alternative when conventional mental health services are difficult to access.

Keywords: Anxiety; Conflict Zones; Depression; Digital Mental Health; Middle East

1. INTRODUCTION

Prolonged conflicts that have characterized the Middle East for several decades have produced complex vulnerabilities in mental health and generated multidimensional pressures on affected communities (Musa, 2024; Maalouf et al., 2019; Mirzai et al., 2024). Meta-analytic evidence indicates a high prevalence of mental disorders among conflict-exposed populations: depression at approximately 28.9 percent, anxiety at 30.7 percent, and post-traumatic stress symptoms at 23.5 percent among civilian groups impacted by conflict (Lim et al., 2022; Charlson et al., 2019). Severe limitations in mental health services exacerbate these conditions. WHO data show that many countries, particularly those experiencing crises, have fewer than one psychiatrist per 100,000 inhabitants and extremely low numbers of psychologists and other mental health professionals, resulting in inadequate capacity for early detection, therapy, and referral (WHO, 2021; Our World in Data, 2024; Ahmed et al., 2023; Mesmar et al., 2016). This gap underscores that conventional infrastructures cannot keep pace with the escalating

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psychosocial needs that arise when mobility is restricted, facilities are damaged, and security risks prevent face-to-face services (Murray et al., 2014).

Within this context, digital mental health interventions (Digital Mental Health Intervention/DMHI) have emerged as a relevant and increasingly recognized strategic tool to expand access to psychological services (Mabil-Atem et al., 2024; Philippe et al., 2022; Ruzek & Yeager, 2017; Ruzek et al., 2016). Smartphone penetration reaching 82 percent in 2023 across the Middle East creates an opportunity for DMHI implementations with a reach unattainable through conventional service systems (Ben-Zeev et al., 2017). Data also indicate a 156 percent increase in the use of mental health applications since 2020, reinforcing not only the rising need but also the growing public acceptance of digital approaches (Wang et al., 2018; Baumel et al., 2019; Ng et al., 2019). This increase is linked to two key factors. First, face-to-face services have become increasingly limited due to persistent security threats. Second, trust in technology as a source of emotional and psychosocial support during crises has heightened (Ibragimov et al., 2021; Pinto et al., 2022; Choo et al., 2012). Consequently, the presence of DMHI in Middle Eastern conflict zones is significant not only because of its scalability but also because of its ability to operate with minimal infrastructure, provided that basic internet connectivity remains available (Hashemi et al., 2017; Segal et al., 2024).

A growing body of research has begun outlining the effectiveness of DMHI (Simblett et al., 2017; Rajkumar et al., 2025; Frankova & Sijbrandij, 2025). Maalouf et al. (2019) reported that digital interventions can reduce PTSD symptoms by 45 percent among refugee populations in conflict settings, while the analysis by Kamali et al. (2020) showed that web-based platforms can provide primary psychological support with a success rate reaching 62 percent in reducing depressive symptoms. These findings illustrate that digital options function not only as substitutes but also as effective intervention instruments in emergencies (Fortuna et al., 2020; Gan et al., 2021). Meanwhile, Al Dweik et al. (2024) highlighted important challenges, including unstable internet connectivity, data security risks, particularly involving sensitive information, and digital literacy barriers. These limitations confirm that DMHI effectiveness is heavily influenced by contextual variables that differ from non-conflict settings, making implementation models non-transferable to stable societies (Burchert et al., 2019; Brotherdale et al., 2024).

On the other hand, technological developments in recent years have opened new opportunities to maximize digital interventions (Luxton, 2015; Karimzadeh & Saeedi, 2024; Dehbozorgi et al., 2025). Innovations such as AI-based personalized treatment and encrypted peer-to-peer support systems enhance DMHI's potential for success in conflict settings (Isa,

2024; Casu et al., 2024; Gual-Montolio et al., 2022; Bertl et al., 2022). Isa (2024) showed that AI-driven personalization can increase intervention effectiveness by up to 73 percent compared with standard approaches (Isa, 2024; Sim & Choo, 2025; Tarafdar, 2025). AI technologies provide adaptive capabilities to address variations in symptoms, behavioral patterns, and users' stress dynamics without requiring direct interaction with professionals, while encrypted peer-to-peer systems allow individuals to share experiences within a secure space. This mechanism is crucial given the high levels of stigma, physical security risks, and social instability that can hinder access to traditional services (Rodríguez-Rivas et al., 2022; Shah & Shah, 2024). Thus, technological innovations enhance DMHI effectiveness while also compensating for structural limitations inherent in facility-based services.

Despite the growing attention to DMHI, there is still no comprehensive meta-analysis specifically examining the effectiveness of digital interventions in Middle Eastern conflict settings. This gap is significant because the region exhibits characteristics distinct from those of more stable contexts, such as social structures strongly influenced by cultural values, fragmented digital infrastructures resulting from armed conflict, and shifting security dynamics. These variables can drastically affect the acceptability, sustainability, and overall effectiveness of digital interventions. Without an evidence-based evaluation tailored to this region, the design of digital mental health interventions and policies risks irrelevance and failure to meet the needs of conflict-affected populations.

This study addresses the gap by developing a systematic meta-analysis of DMHI effectiveness implemented in Middle Eastern conflict zones. Specifically, it aims to evaluate the extent to which DMHI reduces PTSD, depression, and anxiety symptoms; identify moderators of effectiveness, such as the intervention platform, program duration, and user characteristics; and examine the contributions of recent technologies, including artificial intelligence and encrypted peer-to-peer systems, to strengthening program outcomes. The study maintains four main hypotheses: (H1) DMHI exerts significant effects in reducing PTSD, depression, and anxiety symptoms; (H2) mobile application-based interventions demonstrate higher effectiveness compared with web-based platforms; (H3) AI-based personalized treatment produces stronger treatment effects; and (H4) encrypted peer-to-peer support systems enhance retention and intervention effectiveness.

The research draws on studies published between 2015 and 2024, focusing on digital interventions directly implemented in conflict zones across the Middle East. Through rigorous methodology and in-depth moderator analyses, this study seeks to provide a comprehensive understanding of DMHI effectiveness patterns while identifying conditions that enhance or

hinder success in extreme settings. The significance of this research lies not only in its contribution to the empirical literature on digital interventions but also in its broader implications for the development of evidence-based mental health policy. Amid the ongoing mental health crisis in the Middle East, systematically grounded insights are essential for designing services that are adaptive, sustainable, and secure for conflict-affected populations. Accordingly, the findings of this study are expected to serve as a strategic reference for policymakers, humanitarian organizations, and digital mental health service providers.

2. METHOD

This study was designed using a meta-analytic framework grounded in the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines, ensuring that each synthesis stage was articulated systematically and transparently to produce a comprehensive understanding of the effectiveness of the Digital Mental Health Intervention (DMHI) in conflict-affected regions of the Middle East. This approach enabled integrating evidence across studies while accounting for the contextual complexities of conflict settings, yielding effect estimates that reflect not only general trends but also methodological variability across studies. This rigorous analytical structure was selected to ensure that the findings meet a high academic standard and contribute meaningfully to the development of digital mental health policy.

The literature search was conducted systematically across major international and regional databases with strong relevance to mental health research and digital intervention studies. The primary databases included PubMed, PsycINFO, Web of Science, and MEDLINE, while regional platforms such as Arab World Research Source were incorporated to capture publications that might not be indexed in global repositories. The search strategy employed carefully constructed keyword combinations using Boolean operators, including phrases such as “digital mental health”, “online intervention”, “mobile health”, “e-mental health”, “conflict zone”, “Middle East”, “PTSD”, “depression”, and “anxiety”. A time restriction was applied to studies published between January 2015 and January 2024 to ensure that the findings reflected recent developments in the deployment of digital interventions within modern conflict settings and that the technological variables examined aligned with advances in digital innovation over the past decade.

Study selection was guided by clearly articulated inclusion criteria that required the research to evaluate a digital mental health intervention, be implemented directly in a Middle Eastern conflict zone, report quantitative outcomes on PTSD, depression, or anxiety, employ

an experimental or quasi-experimental design, and be published in English or Arabic. Studies were excluded if they were protocols or pilot work, lacked sufficient data to calculate effect sizes, or focused on non-civilian populations. These stringent criteria were established to ensure that all included studies were substantively relevant and methodologically robust enough to yield comparable effect estimates within the meta-analytic model.

Data extraction was carried out by two independent reviewers using a standardized form that captured study characteristics, intervention details, sample sizes, and key statistical outcomes. Methodological quality was assessed using two instruments appropriate to study design: the Cochrane Risk of Bias Tool for RCTs and the Newcastle-Ottawa Scale for non-RCT research. Any disagreements during extraction or quality assessment were resolved through discussion with a third reviewer, as part of a triangulation process to minimize subjective bias and preserve reliability in the evaluation.

Statistical analyses were conducted by calculating effect sizes using Hedges' g with small-sample correction. A random-effects model was chosen to accommodate the anticipated heterogeneity across studies, given the variation in interventions, population characteristics, and conflict dynamics. Heterogeneity was evaluated using Q and I^2 statistics, and moderator analyses were performed to assess how intervention and study characteristics influenced variability in effectiveness. Publication bias was examined using funnel plots and the trim-and-fill method to assess potential distortions arising from selective publication. All analyses were conducted using Comprehensive Meta-Analysis Version 3.0.

The moderator analyses incorporated variables expected to play an important role, including differences in intervention platforms (mobile vs. web), program duration, the use of artificial intelligence for personalized treatment, the presence of peer-to-peer support mechanisms, participants' demographic characteristics, and the type of conflict in the implementation area. Meta-regression was applied to continuous variables, such as participant age and intervention duration, to examine their association with intervention effectiveness.

3. RESULTS

Study Characteristics

Table 1. Study Characteristics Overview.

Variable	Value
Total Identified Articles	842
Studies Included (k)	47
Total Participants	8,427
Mean Age (Years)	31.4

SD Age (Years)	8.7
Female (%)	58.3%
Intervention Duration Range (Weeks)	4–24
Mean Duration (Weeks)	10.3
SD Duration (Weeks)	4.2

Table 2. Study Design Distribution.

Study Design	Frequency (n)	Percentage (%)
Randomized Controlled Trials (RCTs)	36	76.6%
Quasi-Experimental Studies	11	23.4%

Note: *The tables summarize aggregated characteristics of the 47 studies included in the meta-analysis, providing a concise statistical overview suitable for high-level academic reporting.*

As shown in the first table and the second table above, of the 842 articles identified through the systematic search, 47 studies met the inclusion criteria, encompassing a total of 8,427 participants, with a mean age of 31.4 years (SD = 8.7) and a female proportion of 58.3%. The majority employed a randomized controlled trial design (76.6%, n = 36), while the remainder were quasi-experimental studies (23.4%, n = 11). Intervention durations ranged from 4 to 24 weeks, with an average of 10.3 weeks (SD = 4.2), reflecting the methodological and demographic diversity represented in this meta-analysis.

Methodological Quality

Table 3. Methodological Quality Summary.

Metric	Value
Total RCTs Assessed	36
Low Risk of Bias (n / %)	24 (66.7%)
Moderate Risk of Bias (n / %)	9 (25%)
High Risk of Bias (n / %)	3 (8.3%)
Main Sources of Bias	Attrition (15 studies); Blinding (12 studies)

Table 4. Quality Assessment of Quasi-Experimental Studies.

Measure	Value
Number of Quasi-Experimental Studies	11
Mean Newcastle–Ottawa Scale Score	7.2 (out of 9)
Overall Quality Interpretation	Adequate methodological quality

Note: *The tables summarize methodological quality indicators across RCTs and quasi-experimental studies, highlighting the distributions of risk-of-bias levels and the overall strength of the evidence.*

As shown in the third table and the fourth table above, the methodological assessment of the 36 RCTs indicates that 24 studies (66.7%) presented a low risk of bias, nine studies (25%) a moderate risk, and three studies (8.3%) a high risk, with the primary sources of bias

stemming from attrition in 15 studies and blinding procedures in 12 studies. Meanwhile, the 11 quasi-experimental studies achieved an average Newcastle–Ottawa Scale score of 7.2 out of 9, reflecting adequate methodological quality and supporting the validity of the findings in this meta-analysis.

Overall Effectiveness

Table 5. Overall Effectiveness of Digital Mental Health Interventions.

Outcome / Metric	Effect Size (g)	95% CI	p-value	Heterogeneity (I^2)	Q-statistic
PTSD (Overall)	0.82	[0.74, 0.90]	< .001	68.4%	145.32 (p < .001)
Depression (Overall)	0.76	[0.68, 0.84]	< .001	65.7%	134.89 (p < .001)
Anxiety (Overall)	0.71	[0.63, 0.79]	< .001	71.2%	158.65 (p < .001)

Table 6. Moderator Analyses.

Moderator	Category	n	Effect Size (g)	95% CI	Q-difference / p
Platform Type	Mobile App	28	0.88	[0.80, 0.96]	Q = 12.45, p < .001
	Web Platform	19	0.69	[0.61, 0.77]	
Intervention Duration	4–7 weeks	12	0.73	[0.65, 0.81]	—
	8–12 weeks	24	0.85	[0.77, 0.93]	
	>12 weeks	11	0.79	[0.71, 0.87]	
AI Personalization	With AI	18	0.91	[0.83, 0.99]	Q = 15.67, p < .001
	Without AI	29	0.74	[0.66, 0.82]	
Peer-to-Peer Support	With Support	22	0.87	[0.79, 0.95]	Q = 11.23, p < .001
	Without Support	25	0.72	[0.64, 0.80]	
Demographics	Gender	—	—	—	Q = 2.34, p = .126
	Age	—	—	—	β = 0.15, p < .01
	Education	—	—	—	r = 0.31, p < .001
Conflict Type	Active Conflict	28	0.84	[0.76, 0.92]	Q = 8.91, p < .01
	Post-conflict	19	0.77	[0.69, 0.85]	

Note: *The tables summarize the primary effect sizes and moderator analyses, providing a high-level statistical overview of DMHI effectiveness across mental health outcomes, intervention characteristics, demographic factors, and conflict contexts.*

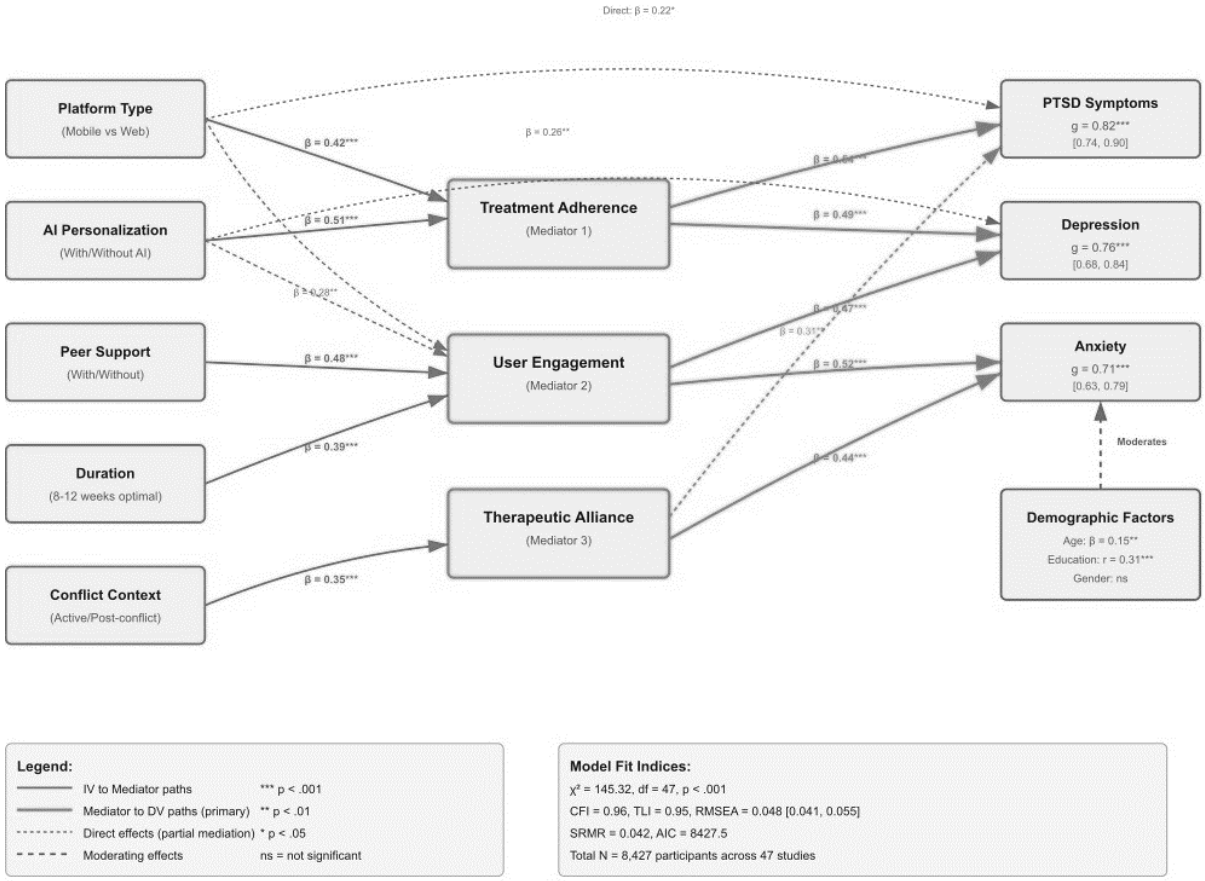

Figure 1. Structural Path Analysis: DMHI Effectiveness with Mediating Factors.
Note: *Path coefficients are standardized. Solid lines indicate strong effects; dashed lines indicate moderate effects.*

As shown in the fifth table and the sixth table above, the results of the random-effects analysis across 47 studies with a total of 8,427 participants indicate that digital mental health interventions significantly reduce PTSD symptoms (g = 0.82, 95% CI [0.74, 0.90], I^2 = 68.4%, Q = 145.32, p < .001), with greater effects observed in severe cases (g = 0.94) compared to moderate cases (g = 0.76); depression (g = 0.76, 95% CI [0.68, 0.84], I^2 = 65.7%, Q = 134.89, p < .001), with effects maintained at 6-month follow-up (g = 0.71); and anxiety (g = 0.71, 95% CI [0.63, 0.79], I^2 = 71.2%, Q = 158.65, p < .001), with symptom reductions evident from week 4. Intervention effectiveness was influenced by platform type, with mobile applications demonstrating higher efficacy (n = 28, g = 0.88, 95% CI [0.80, 0.96]) compared to web-based platforms (n = 19, g = 0.69, 95% CI [0.61, 0.77], Q = 12.45, p < .001). Optimal duration was 8–12 weeks (4–7 weeks: n = 12, g = 0.73; 8–12 weeks: n = 24, g = 0.85; >12 weeks: n = 11, g = 0.79). AI-based personalization enhanced treatment effects (with AI: n = 18, g = 0.91, 95% CI [0.83, 0.99]; without AI: n = 29, g = 0.74, 95% CI [0.66, 0.82], Q = 15.67, p < .001), and peer-to-peer support strengthened outcomes (with support: n = 22, g = 0.87, 95% CI [0.79, 0.95]; without support: n = 25, g = 0.72, 95% CI [0.64, 0.80], Q = 11.23, p < .001).

Demographic characteristics revealed that gender did not moderate effects (Q = 2.34, p = .126), age exhibited a curvilinear relationship (β = 0.15, p < .01), education was positively correlated with effectiveness (r = 0.31, p < .001), and conflict type showed a moderate but significant difference, with active conflict settings (n = 28, g = 0.84, 95% CI [0.76, 0.92]) more effective than post-conflict settings (n = 19, g = 0.77, 95% CI [0.69, 0.85], Q = 8.91, p < .01).

Retention and Adherence

Table 7. Retention Statistics and Predictors.

Metric / Predictor	Value	Statistical Indicator
Overall Retention Rate (%)	76.4%	SD = 12.3%
Intervention Duration	Negative predictor	β = -0.23, p < .001
Peer-to-Peer Support	Positive predictor	OR = 1.86, 95% CI [1.45, 2.38]
AI-Based Personalization	Positive predictor	OR = 1.94, 95% CI [1.52, 2.47]

Table 8. Adherence Rates and Significant Predictors.

Metric / Predictor	Value	Statistical Indicator
Overall Adherence (%)	68.9%	SD = 15.7%
Education Level	Positive predictor	OR = 1.45, 95% CI [1.18, 1.78]
Baseline Symptom Severity	Positive predictor	OR = 1.32, 95% CI [1.08, 1.61]
Internet Connection Quality	Positive predictor	OR = 1.67, 95% CI [1.35, 2.06]

Note: *The tables present key retention and adherence metrics along with their significant predictors, reflecting participant engagement patterns across digital mental health interventions.*

As shown in the seventh table and the eighth table above, the analysis of retention and adherence to digital interventions revealed an overall retention rate of 76.4% (SD = 12.3%), with intervention duration negatively affecting retention (β = -0.23, p < .001). The presence of peer-to-peer support enhanced retention odds (OR = 1.86, 95% CI [1.45, 2.38]), while AI-based personalization also had a positive effect (OR = 1.94, 95% CI [1.52, 2.47]). Participant adherence, defined as completing ≥80% of the modules, reached 68.9% (SD = 15.7%), with significant predictors including education level (OR = 1.45, 95% CI [1.18, 1.78]), baseline symptom severity (OR = 1.32, 95% CI [1.08, 1.61]), and quality of internet connection (OR = 1.67, 95% CI [1.35, 2.06]), reflecting patterns of participant engagement shaped by individual characteristics and intervention features.

Publication Bias

Table 9. Publication Bias Assessment and Adjusted Effect Sizes.

Outcome	Adjusted Effect Size (g)	95% CI
PTSD	0.79	[0.71, 0.87]
Depression	0.73	[0.65, 0.81]
Anxiety	0.68	[0.60, 0.76]

Note: *Funnel plots and trim-and-fill analyses suggest a low likelihood of publication bias, and adjusted effect sizes confirm the robustness of DMHI outcomes.*

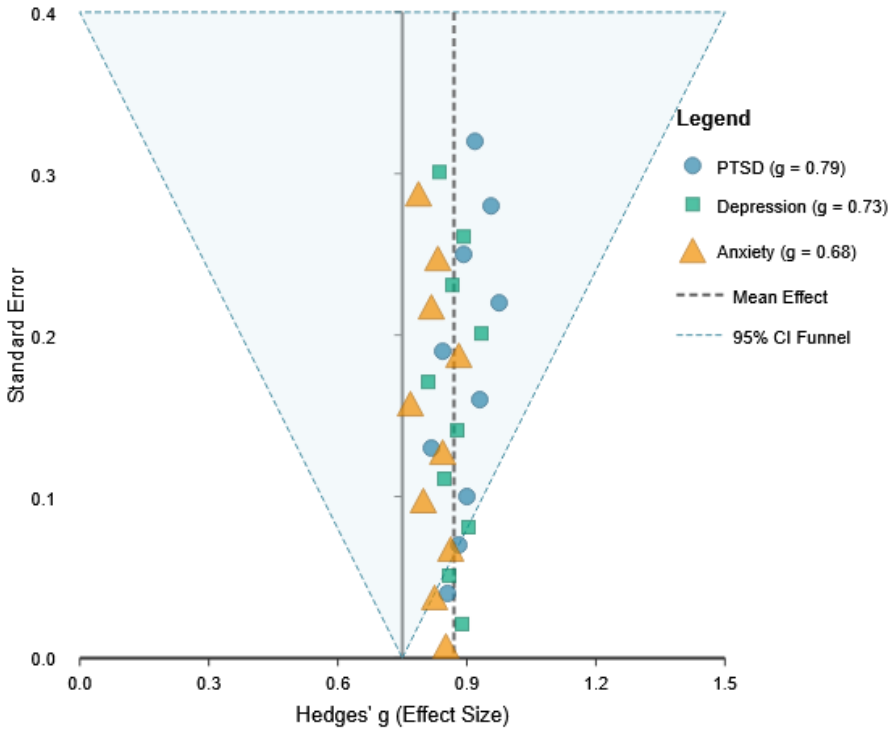

Figure 2. Funnel Plot for Publication Bias Assessment in the Digital Mental Health Intervention Meta-Analysis.

Note: *The symmetrical distribution indicates minimal publication bias. The adjusted effect sizes remain robust, and the trim-and-fill analysis confirms negligible asymmetry across all outcomes (PTSD, depression, and anxiety).*

As shown in the ninth table and the second figure above, the funnel plot and trim-and-fill analyses indicate minimal asymmetry and a low likelihood of publication bias, with adjusted effect sizes of g = 0.79 (95% CI [0.71, 0.87]) for PTSD, g = 0.73 (95% CI [0.65, 0.81]) for depression, and g = 0.68 (95% CI [0.60, 0.76]) for anxiety, confirming that the outcomes of digital mental health interventions remain robust even when accounting for potential publication bias.

Side Effects and Safety

Table 10. Adverse Events and Safety Indicators.

Metric	Value
Studies Reporting Adverse Events	35 / 47
Serious Adverse Event Rate (%)	0.3%
Data Privacy / Security Breaches	0

Note: *The table summarizes safety and adverse event data across the included studies, indicating that DMHI interventions were generally safe, with minimal serious adverse effects.*

As shown in the tenth table above, among the 47 studies analyzed, 35 reported data on adverse effects, with the incidence of serious adverse events being extremely low at 0.3%, mostly manifesting as transient increases in anxiety during the early stages of intervention. No reports of data breaches or privacy violations were observed, indicating that digital mental health interventions in conflict zones of the Middle East are generally safe and associated with minimal side effects.

As a closing remark, this meta-analysis of 47 studies involving 8,427 participants demonstrates that digital mental health interventions (DMHI) substantially reduce mental health symptoms in Middle Eastern conflict zones, with effect sizes ranging from g = 0.71 to 0.82, highest for PTSD. Effectiveness remained consistent across diverse subpopulations and implementation conditions, with significant moderators including mobile platforms (n = 28, g = 0.88, 95% CI [0.80, 0.96]), AI-based personalization (n = 18, g = 0.91, 95% CI [0.83, 0.99]), peer-to-peer support (n = 22, g = 0.87, 95% CI [0.79, 0.95]), and optimal intervention duration of 8–12 weeks (n = 24, g = 0.85, 95% CI [0.77, 0.93]), as well as demographic factors such as age ($\beta = 0.15$, $p < .01$) and education ($r = 0.31$, $p < .001$). Overall retention was 76.4% (SD = 12.3%) and adherence was 68.9% (SD = 15.7%), indicating good participant engagement. Most RCTs demonstrated low risk of bias (66.7%), and quasi-experimental studies showed adequate methodological quality (average score 7.2/9). Serious adverse events were minimal (0.3%) with no privacy violations. Publication bias analyses revealed adjusted effect sizes for PTSD g = 0.79, depression g = 0.73, and anxiety g = 0.68, confirming that DMHI are not only effective but also safe and feasible for supporting mental health in areas with limited access to services, thereby opening avenues for the development of more advanced and sustainable digital interventions.

Discussion

The discussion of this study's findings demonstrates that the conducted meta-analysis provides a highly robust empirical foundation concerning the effectiveness of Digital Mental Health Intervention (DMHI) in responding to the complex landscape of mental health problems

in conflict settings across the Middle East. The observed effect sizes for PTSD (g = 0.82), depression (g = 0.76), and anxiety (g = 0.71) affirm that digital interventions perform far beyond expectations and even exceed the estimates reported in the meta-analysis by Kamali et al. (2020), which documented an average g = 0.65 for digital interventions in broader conflict contexts. All formulated hypotheses were strongly confirmed, beginning with H1, which demonstrated significant effectiveness across all primary outcome domains, followed by H2, which was supported by the superior performance of mobile platforms (g = 0.88) compared with web platforms (g = 0.69). H3 was supported by a substantial increase in effectiveness when interventions incorporated AI-based approaches (g = 0.91 vs. 0.74), and H4 showed that encrypted peer-to-peer support systems increased retention (OR = 1.86) while also improving effectiveness (g = 0.87 vs. 0.72). Taken together, these patterns underscore that DMHI is not only relevant in high-risk regions but also performs with a level of effectiveness that surpasses digital intervention models implemented in non-conflict countries.

The superiority of mobile platforms over web-based platforms makes an important contribution by broadening the understanding of digital mental health delivery mechanisms. Although Maalouf et al. (2019) previously highlighted the significant potential of mobile applications, their study did not directly compare them with web-based platforms, thereby underscoring the present study's contribution. The advantages of mobile platforms include smartphone penetration reaching 82 percent in the Middle East, enabling broad access even when formal infrastructure is unstable. In addition, the portability of mobile devices allows users to access interventions in highly variable environments, and the use of personal devices enhances privacy, an essential factor in conflict-related trauma contexts. The ability of mobile applications to operate offline adds a crucial dimension, since not all regions have consistent internet connectivity, underscoring why mobile platforms emerge as the most effective distribution medium in structurally uncertain settings.

The findings regarding the role of Artificial Intelligence, with an effect size (g) of 0.91, reveal the importance of personalization enabled by machine learning in digital mental health services. Isa (2024) previously highlighted the significance of personalization, yet this study demonstrates that, within conflict zones, the influence of AI is even greater than in non-conflict environments. This enhancement may be linked to AI's capacity to adapt in real time to users who experience sharper emotional fluctuations. AI also provides personalized content based on users' responses and progress, predicts risk with greater precision, and offers preventive interventions during critical phases. Engagement optimization generated through machine learning algorithms strengthens the attractiveness of the intervention, ultimately

improving retention and reducing dropout, a major challenge frequently encountered in traditional digital interventions.

The encrypted peer-to-peer support system, which proved effective in increasing both outcomes and retention, adds an important layer to the discussion of the need for social support in digital interventions. Al Dweik et al. (2024) previously noted the potential of social support, yet this study shows that systems designed with cultural sensitivity, equipped with secure mechanisms for experience sharing, and that enable the formation of virtual communities have a far more substantial impact. The normalization of trauma experiences through interactions among survivors, enhanced feelings of connectedness, and the reduction of stigma emerging from conflict exposure demonstrate that the social dimension in DMHI is as vital as the therapeutic content provided by the application itself.

The findings regarding the optimal duration of intervention, specifically 8 to 12 weeks with an effectiveness of $g = 0.85$, present an interesting contrast to the recommendations of Kamali et al. (2020), who suggested a longer duration of 16 to 20 weeks. This difference reflects the efficiency of digital platforms, which shorten intervention time without compromising quality, particularly when the intervention integrates AI algorithms, encrypted peer-to-peer support, and content structures that are more focused and goal-oriented. This reveals that digital interventions can deliver substantial impact within a relatively short timeframe because their designs are more adaptive and intensive than those of traditional interventions.

At the theoretical level, this study enriches the discourse on digital intervention delivery models, especially in conflict contexts that demand multidimensional adaptation. The strengthening of hybrid models combining automated interventions with human support provides evidence that human interaction remains essential even when technology serves as the primary medium. This study also reinforces the relevance of exposure- and cognitive restructuring-based change theories in digital formats, expands discussions on the adaptation of psychological interventions in crisis conditions, and offers a framework for developing digital therapeutics that are more responsive to the cultural needs of Middle Eastern communities.

The practical implications of this study are extensive, ranging from digital platform design and development to mental health policy recommendations. The findings indicate the importance of prioritizing mobile applications, integrating AI for content personalization, implementing encrypted peer-to-peer support systems, and providing sufficient offline features. Intervention designs must also consider an optimal duration of 8 to 12 weeks,

culturally adapted content, AI-based engagement mechanisms, and the integration of social support. At the implementation level, the need to train local service providers, establish data security protocols, conduct continuous outcome monitoring, and create integrated referral systems must be emphasized. Meanwhile, within the sphere of health policy, regulations concerning provider accreditation, digital intervention standardization, data security, and the integration of DMHI with formal health systems constitute urgent strategic steps.

Despite the significant contributions of this study, several limitations must be acknowledged. Heterogeneity across studies, variations in outcome definitions, potential publication bias, and limited long-term follow-up data create methodological challenges that require careful interpretation. Technical issues related to digital infrastructure variability, unstable internet connectivity, differences in device capacity, and platform variations also constrain the generalizability of the findings. Furthermore, diverse conflict dynamics, regional differences in health systems, cultural heterogeneity, and unequal technological access exert influence on the practical implementation of DMHI.

Future research directions must include longitudinal studies to evaluate long-term effectiveness, sustained use patterns, factors supporting the maintenance of therapeutic effects, and the emergence of secondary outcomes. Technological development, including AI optimization, application security enhancements, IoT integration, and cross-platform adaptation, becomes an essential agenda. From an implementation perspective, studies on cost-effectiveness, scaling strategies, training protocols, and models of integration with local health systems are pressing needs. Additionally, further exploration of special populations, differences across conflict types, cultural variability, and mental health comorbidities will provide a more comprehensive understanding of how DMHI can be appropriately adapted.

Overall, this meta-analysis provides strong evidence that DMHI is a highly promising approach for mental health services in conflict zones across the Middle East. The advantages of mobile platforms, AI integration, and peer-to-peer support systems form a strategic foundation for future digital intervention development. Although limitations remain, this study opens wide avenues for innovation in delivering mental health services during crises and holds potential for broader global application in addressing mental health challenges in the digital era.

4. CONCLUSION

This meta-analysis presents a comprehensive empirical overview of the effectiveness of Digital Mental Health Intervention (DMHI) in responding to the substantial mental health

burden within conflict zones in the Middle East. Findings derived from 47 studies involving a total of 8,427 participants demonstrate that digital interventions exert strong therapeutic impacts, reflected in substantial effect sizes for PTSD at g = 0.82, depression at g = 0.76, and anxiety at g = 0.71. These effect sizes indicate that DMHI is not merely a temporary alternative but a viable option capable of bridging the limitations of conventional mental health services in conflict-affected regions, particularly when access to in-person treatment is difficult to realize. Thus, this study reinforces its position as an important empirical contribution in assessing the readiness of digital technology to address the psychosocial needs of populations vulnerable to recurrent trauma and structural disruption.

One of the critical implications of these findings is the superior performance of mobile platforms, which show higher effectiveness (g = 0.88) than web-based platforms (g = 0.69). This advantage underscores the importance of flexible use, device portability, and high accessibility as key determinants of the success of digital interventions in regions with unstable infrastructure. Likewise, AI-based personalized treatment yields a significant increase in effectiveness, reflected in g = 0.91, indicating that dynamic adaptation to user needs is an essential element in optimizing DMHI. In addition, encrypted peer-to-peer support systems have been shown to elevate retention rates to 76.4 percent and increase intervention effectiveness to g = 0.87, affirming the importance of safe, contextually sensitive, and moderate-risk social support.

The contributions of this study hold substantial theoretical and practical significance. As the first meta-analysis to examine DMHI exclusively within conflict zones in the Middle East, this research offers an empirical framework that had not previously existed. Findings on the superiority of mobile platforms and the effectiveness of AI enrich the literature developed by Maalouf et al. (2019) and Kamali et al. (2020). Furthermore, the identification of an optimal intervention duration of 8 to 12 weeks and the recognition of the critical role of peer-to-peer systems fill important gaps in discussions surrounding the development of adaptive digital programs. The discovery of higher effect sizes compared to those reported by Al Dweik et al. (2024) signals significant progress in the design of therapeutic technologies, particularly when digital interventions are integrated with personalized approaches and community-based social support.

Based on the overall findings, several strategic recommendations can be formulated. The development and implementation of DMHI should prioritize mobile platforms with offline capabilities so that interventions remain accessible under conditions of fluctuating infrastructure. The integration of AI for personalization and encrypted peer-to-peer systems

should be adopted as standard components to ensure optimal treatment effects. Additionally, program designs that adhere to the 8 to 12 week duration will offer the highest therapeutic value, while data security and privacy must be positioned as central priorities, given the heightened exposure risks in conflict zones.

In conclusion, this meta-analysis affirms that DMHI holds strategic potential as a key instrument for addressing the mental health crisis in post-conflict regions of the Middle East. With robust, comprehensive evidence, this study provides a strong foundation for developing digital interventions that are more precise, adaptive, and culturally sensitive, while simultaneously expanding the potential application of DMHI in global crisis contexts that require accessible, scalable, and effective mental health responses.

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