

SYSTEMATIC REVIEW

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Opportunities and challenges in leveraging digital technology for mental health system strengthening: a systematic review to inform interventions in the United Arab Emirates

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Abstract

Digital technology offers scalable, real-time interventions for mental health promotion and treatment. This systematic review explores the opportunities and challenges associated with the use of digital technology in mental health, with a focus on informing mental health system strengthening interventions in the United Arab Emirates (UAE). Following PRISMA guidelines, a systematic search of databases was conducted up to August 2023 and identified a total of 8479 citations of which 114 studies were included in the qualitative analysis. The included studies encompass diverse digital interventions, platforms, and modalities used across various mental health conditions. The review identifies feasible, acceptable, and efficacious interventions, ranging from telehealth and mobile apps to virtual reality and machine learning models. Opportunities for improving access to care, reducing patients' transfers, and utilizing real-world interaction data for symptom monitoring are highlighted. However, challenges such as digital exclusion, privacy concerns, and potential service replacement caution policymakers. This study serves as a valuable evidence base for policymakers and mental health stakeholders in the UAE to navigate the integration of digital technology in mental health services effectively.

Keywords Digital mental health, Health system strengthening, Health policy, Public health

Introduction

Digital technology has emerged as a sustainable and scalable tool for real-time interventions in mental health promotion and care [1]. It can reduce the prevalence of diseases and enhance mental health in communities by collecting, analyzing, and using data from a range of digital gadgets [2]. In the United Arab Emirates (UAE), the adoption of digital technologies in healthcare has been growing rapidly, especially during the COVID-19 pandemic [3, 4]. According to the Philips Health Trends Research for the UAE, there is high acceptance of digital health technologies, with 95% of respondents believing

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that technology can play an important role in managing their health more efficiently. Additionally, 72% of participants believe that virtual discussions with their doctors are as effective as face-to-face examinations [5].

Digital interventions are technology-driven, self-help, supervised, or unsupervised interventions focused on offering support for physical and mental health [6]. Various concepts such as mobile health (mHealth) and internet-based (eHealth) therapies powered by digital technologies are gaining ground to provide effective treatments for mental illnesses [7]. These interventions come in various forms, including telepsychiatry and mobile apps, which are being increasingly implemented in the UAE to enhance mental health services [8]. In Abu Dhabi, for example, mental health services were remodeled during the COVID-19 pandemic and tele-assessment mental health visits comprised 60% of all visits during April–May, 2020 [9].

Numerous research studies suggest that digital interventions are equally as effective as face-to-face therapy and more successful than standard care in the case of common anxiety disorder, depression, and cancer-related distress [10, 11]. Also, past systematic studies have found that videoconferencing-based counseling and psychotherapy can be effective and useful for a variety of age groups, urban and rural contexts, and mental health conditions such as anxiety [12]. Many studies have been carried out throughout the world to pinpoint possible factors that can promote and hinder the adoption of digital mental health such as reach, engagement (intervention) uptake, and outcome optimization [13–15]. It has been established that virtual reality (VR) technology is suitable, secure, and effective for both physical and psychological rehabilitation [16, 17]. On the contrary, some critics have claimed that the use of digital technology for mental health is a “one size fits all” approach, however, each case deserves a distinct intervention multidisciplinary diagnosis, and treatment [18].

A recent study found that nearly 60% of Portuguese psychologists perceived the techniques for remote psychological evaluation as inaccurate, increasing the risk of misdiagnosis, citing inadequate training and lack of experience as factors contributing to negative attitudes [19]. In addition, 30% of respondents in another study deemed digital evaluation to be precarious, primarily when assessing patients who were at significant risk of suicide [20]. However, evidence showed that the risk assessment of suicide can be obtained effectively via videoconference and in-home messaging devices as equally as it could be done in person [21]. Similarly, some studies have suggested that using digital technology will improve the current collaboration and prompt access to mental health services [7]. Nonetheless, several studies have transversally shown that many medical professionals lack

training and expertise in digital mental health, which is why digital interventions end up in trial and error [22]. Moreover, several barriers to implementation are commonly quoted as the lack of ethical, legal, and regulatory frameworks for providing web-based mental health care [23], and potential security and confidentiality issues with digital systems [19]. Understanding the opportunities and challenges associated with the integration of digital technology in mental health services is vital for informed policymaking and the strengthening of mental health systems. The goal of this study was to consolidate the opportunities and challenges in leveraging digital technology for mental health system strengthening, to provide evidence-based to guide policymakers and mental health stakeholders in leveraging digital technology to strengthen mental health interventions in the UAE.

Methods

This study was conducted according to the Preferred Reporting Items of Systematic Reviews and Meta-Analysis (PRISMA) guidelines [24]. The protocol for the study was registered in the International Prospective Register of Systematic Reviews (PROSPERO 2023 CRD42023472455).

Data sources and search strategy

Databases including PubMed, EMBASE, PsycINFO, CINAHL, and the Cochrane Database were searched up to August 2023. Searches were limited to open access, English-language publications, and no other search restrictions were applied. Additional studies were identified by scanning the bibliographies of relevant reviews and eligible articles. An example of search terms used in different platforms is available in Supporting File 1.

Stud selection and inclusion

All studies self-identified as qualitative, quantitative, or mixed-methods original research reporting opportunities and/or challenges for the use of digital technology-specific mental health conditions were included. We excluded non-English language publications, opinion papers, editorials, commentaries, systematic reviews, and meta-analyses.

Data extraction (selection and coding)

All potentially eligible records were imported into Covidence systematic review management software and duplicate references were eliminated [25]. Two reviewers independently screened titles and abstracts using the pre-defined inclusion criteria, and a third reviewer resolved any detected conflicts. Two reviewers have independently assessed full texts against the inclusion criteria, with any remaining disagreements resolved through discussion with the project team. The data were extracted to include

all details specific to the review question, including (i) authors, publication date, and study setting; (ii) sample characteristics, design, and data collection methods; and (iii) study findings.

Risk of bias (quality) assessment

The risk of bias in the included studies was assessed independently by two reviewers, with discrepancies resolved by the corresponding author. All eligible studies were assessed for quality, but no study was excluded on the grounds of quality. Quality assessment was assessed using the Newcastle-Ottawa Scale for quality assessment of observational studies, and its customized version for non-randomized trails [26], while randomized controlled trials were using Cochrane guidelines for quality assessment of RCTs [27]. The quality assessment of included studies is available in Supporting File 2.

Results

The initial search generated a total of 8479 citations where 1975 duplicates have been identified and removed by Covidence software or manually. Following the title and abstract screening for 6504 articles, 5174 were not relevant and from 1329 full-text articles retrieved and

screened against the inclusion criteria, a total of 114 were included in the qualitative analysis (Fig. 1).

The included studies comprised a diverse range of perspectives from patients, healthcare workers, or both. Digital mental health interventions have been evaluated using different study designs and across various patient populations including traumatized children [28], individuals with social [29], generalized anxiety disorder (GAD) [30–33] and related disorders [34], depressive symptoms including late-life, post-partum, antenatal and postnatal depression [35–44], obsessive-compulsive disorder [45–50], schizophrenia [51–54], autism spectrum disorder [55], bipolar disorder [56], post-traumatic stress disorder (PTSD) [57–62], attention deficit hyperactivity disorder (ADHD) [63], substance use disorder [64, 65], panic disorder [66, 67], social phobia [68] and interventions for multiple mental health conditions [69–78]. A detailed summary of the included studies is available in Supporting File 3.

Digital mental health interventions, platforms, and modalities

Digital mental health interventions in the included studies span a broad array of technology platforms and

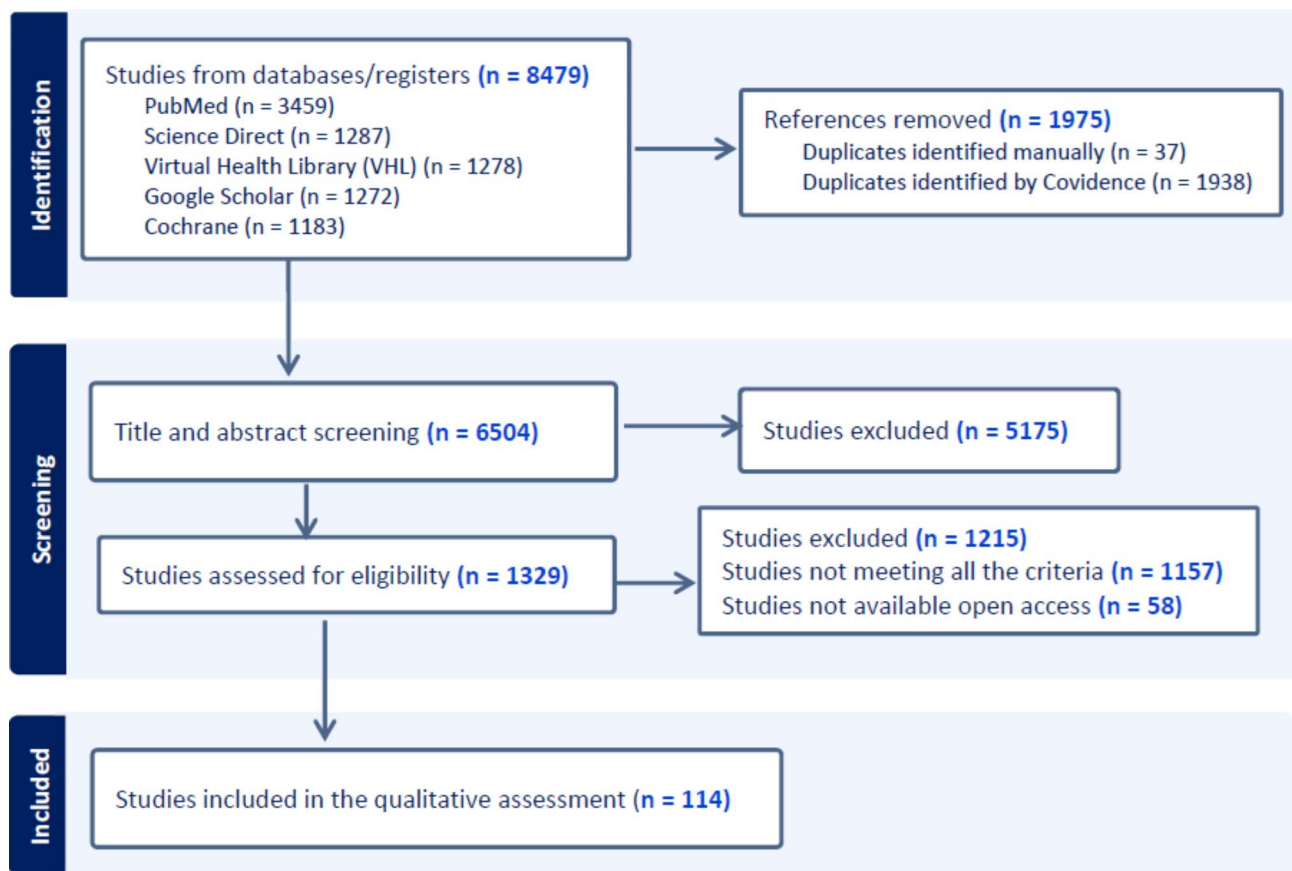


Fig. 1 PRISMA flow chart of included studies

telemental health modalities. These include utilizing platforms such as Zoom and other video platforms [79, 80], technology-supported mindfulness-based interventions [48, 81], VR technology [55], telemedicine mobile technologies [53, 82–84], and app-based interventions [76, 85–88], wearable devices [52, 56] and interventions utilizing cognitive control through entertainment software [38]. In addition to telephone-delivered interventions, spanning from telephone Cognitive behavioral therapy (CBT) [35] to nurse-delivered interpersonal psychotherapy (CNM-IPT) [89], and text messages [90]. Collaborative care models such as Telepsychiatry Collaborative Care (TCC) and Telepsychiatry/telepsychology Enhanced Referral (TER) integrate videoconferencing and digital platforms to enhance mental health support [91].

Opportunities for the use of digital technology in mental health

Feasibility, acceptance, and efficacy of digital interventions increase access to care

Patients and practitioners expressed a preference for continuing the use of telemental health including telephone-based and video-based services, as a sustainable mode of service delivery [45, 79, 92, 93] particularly valuable in rural areas, addressing the issue of limited access to mental health care [94–96]. Internet-guided self-help, individualized e-mail therapy, scenario-based CBT, mobile phones, and computer-aided telephone support were identified as feasible, acceptable, and efficacious mediums for service delivery [76, 97, 98], highlighting the diverse approaches available to practitioners and patients to overcoming barriers to access, particularly for patients with severe mental illness and chronic psychiatric disorders [51, 99–101]. The delivery of PowerPoint e-CBT modules via email was found to be a viable method for delivering CBT to individuals with GAD and a simple method for overcoming language, cultural, and travel barriers to accessing mental health resources [102].

Concerning specialized populations and conditions, digital health interventions were found to be acceptable, empowering individuals to take ownership of their healthcare needs [103]. Telepsychiatry in clinically unsupervised settings was considered feasible and as effective as standard care for depressed outpatients in terms of clinical outcomes, patient satisfaction, therapeutic relationship, and medication compliance [104]. Psychotherapy via telehealth for psychogenic nonepileptic seizures (PNES) was recognized as a viable option, eliminating barriers to access to mental health care [105], and online mental health treatment showed significant reductions in anxiety and depression in migrants [106]. Tele-delivered Problem-Solving Therapy (PST) for low-income homebound older adults was identified as an efficacious and economically viable treatment [107], and telepsychiatry

was reported to be effective in treating posttraumatic stress symptoms, even in unstable and insecure settings [59], emphasizing the capability of digital interventions for reducing barriers to mental care.

Utilization of real-world patient interaction data for monitoring symptoms

Mobile health interventions, particularly those utilizing apps, were acknowledged as potential tools for mood tracking and assessment in youth with mental health problems [108]. Real-world interaction data from smartphones can be utilized as an early warning system detecting mood instability and changes and Ecological Momentary Assessment (EMA) approaches connect different forms of pervasive technology interaction (smartphones, wearables, social robots) to track everyday health status [56]. Another study of machine-learning models reported that patients' social media activity captures objective linguistic and behavioral markers of psychotic relapse in young individuals with recent onset psychosis, and that machine-learning models were capable of making personalized predictions of imminent relapse hospitalizations at the patient-specific level using Facebook social media platform data [109]. Moreover, a study demonstrated the potential of smartphones with behavioral-sensing-installed data to identify behavioral patterns linked to symptomatic decline, enabling inferential modeling of sensor stream features to understand critical behavioral patterns [110].

Improving clinical outcomes and reducing patient transfer

Telehealth interventions, such as a one-time brief telephone intervention, were effective in engaging service members in PTSD treatment earlier, leading to immediate symptom reduction [58]. Other interventions, such as Tele-CBT and internet-based CBT, and other web-based self-help tools were effective in improving psychological distress and disordered eating [82, 111–114]. Also, scenario-based CBT apps demonstrated efficacy in reducing symptoms and improving mental health outcomes [85, 93].

Moreover, telepsychiatry showed significant effects on anxiety, with positive trends observed for depression [115–119], and other platforms demonstrated to positively influence the clinical condition of individuals with paranoid schizophrenia and related conditions [53, 120]. Similarly, patients with psychogenic nonepileptic seizures treated remotely with manual-based seizure therapy decreased seizure frequency and comorbid symptoms and improved functioning using telehealth [105]. Mobile phone-based assessments were recognized for their potential benefits in clinical care [90] and patient engagement with mobile apps was associated with improved outcomes [121]. The Strongest Families intervention,

delivered remotely proved more effective than usual care in treating mild to moderate pediatric mental health disorders remotely using nonprofessionals [122].

Transdiagnostic and antidepressant interventions delivered via telehealth platforms, including decision support, proved effective in detecting and reducing suicidal ideation [123–125]. Additionally, nurse/midwife-delivered telephone Interpersonal Psychotherapy (IPT) was identified as an effective treatment for postpartum depression and anxiety [44, 89]. The ability for psychiatrists to see mental health patients via videoconferencing reduces the probability of patient transfers, aligning with patient preferences to remain in their communities [126].

Challenges to the use of digital technology in mental health

Extant barriers and concerns in digital mental health utilization

Despite the overall acceptability of digital mental health interventions due to their empowering nature for self-management, concerns including the potential for digital exclusion, privacy, and confidentiality were identified especially among older people [103, 127]. Additionally, there were fears that digital health interventions might be perceived as a complete replacement for all mental health services, raising caution regarding their comprehensive effectiveness [103].

Barriers to digital health utilization were reported as individuals with lower educational attainment faced challenges in using telehealth interventions indicating the need for targeted outreach and programming to enhance telehealth utilization [128]. Barriers included discomfort with tele-mental health, difficulties in connecting with providers, perceptions of decreased session numbers, technological challenges, and concerns about the effectiveness of phone-based interactions [129]. Despite the growth in telemental health use, it was reported to be insufficient in eliminating overall rural-urban differences in specialty care utilization [95], indicating persistent challenges in bridging the gap in access to mental health services between rural and urban populations. Also, mHealth transitions of care intervention (Mobile After-Care Support) for adults with schizophrenia-spectrum disorders immediately following a psychiatric hospitalization, are not routinely utilized in real-world clinical settings due to barriers related to feasibility, cost, and access [130].

Technology/modality -specific challenges and barriers

While app-based CBT demonstrated some clinical benefits, a study identified a range of barriers to engagement and emphasized caution in interpreting findings related to app effectiveness and careful consideration of the challenges associated with widespread adoption

[131]. Also, the use of certified nurse-midwife telephone-administered Interpersonal Psychotherapy (CNM-IPT) presented challenges related to availability, highlighting the critical need for a careful assessment of intervention feasibility, and more research is still needed to evaluate the translation of such interventions into practice [89]. Although the addition of videoconferencing to regular care had a positive effect on patient satisfaction, overall, its impact was reported to be limited, and it might not offer significant added value to standard care for severe mental illness [132]. Finally, a study comparing in-person and home-based teletherapy for PTSD highlighted the need for increased doses (more sessions) to achieve therapeutic outcomes in home-based telehealth [61].

Mixed satisfaction with technology-mediated interactions

A study reported variability in satisfaction levels and reluctance with digital mental health as some individuals expressed satisfaction with technology-mediated interactions, while others were less content and remained hesitant about future use of digital mental health [133], prompting the need for more evidence on preferences and experiences with technology-mediated mental health interactions. Another study reports that youth at clinically high risk for psychosis or in the early stages exhibited communication patterns and perceptions in digital contexts that significantly differed from community controls such as reductions in the quality and quantity of social interactions [134].

Discussion

This study lays a robust foundation for informing mental health system strengthening interventions in the UAE, offering both promising opportunities and challenges to address in the integration of digital technology in mental healthcare provision. The current study identified a diverse range of digital mental health interventions, platforms, and modalities, including teletherapy, mobile apps, virtual reality therapy, and wearable devices. These technologies offer promise in increasing access to care, improving clinical outcomes, and empowering individuals to manage their mental well-being effectively.

The study reveals the potential of real-world interaction data from smartphones for monitoring symptoms, offering a proactive approach through early warning systems and ecological momentary assessments. Machine learning models, tapping into patients' social media activity, demonstrate a groundbreaking capacity to predict psychotic relapses, showcasing the transformative power of technology in predictive and preventive mental health care. Moreover, digital interventions in the current study prove effective across a spectrum of mental health conditions, including PTSD, schizophrenia, and anxiety disorders. From Tele-CBT to nurse-delivered interpersonal

psychotherapy, the diverse modalities cater to specialized populations, emphasizing the versatility of digital technology in mental health care. Furthermore, Innovative platforms like virtual reality technology and machine learning-driven models align with global trends, showing the potential to revolutionize mental health care. This study also reveals the effectiveness of smartphone behavioral-sensing-installed data, paving the way for personalized and patient-specific interventions. Policymakers can utilize this evidence to design tailored mental health programs that address the unique needs of different populations within the UAE.

The recent inauguration of the 'Mindspire' app at the UAE Innovates event at Expo by the Dubai Health Authority exemplifies the country's commitment to leveraging technology to enhance mental health services [135]. By employing non-intrusive analysis and machine learning algorithms, the app offers personalized support and interventions for individuals suffering from depression. In addition, various other digital mental health technologies and platforms have emerged such as mobile applications, teletherapy platforms, wearable devices, and online counseling services. Platforms like Ayadi, Bright Shift, and LifeWorks offer online therapy sessions, providing individuals with convenient access to mental health support from qualified professionals [136].

The UAE's digital health landscape also encompasses innovative approaches such as mindfulness-based interventions, virtual reality therapy, and machine learning algorithms for mood tracking and personalized recommendations. These technologies leverage artificial intelligence and data analytics to provide tailored interventions and support individuals in managing their mental well-being effectively [137]. However, Despite the proliferation of mental health, there remains a dearth of formal evaluations, highlighting the need for robust assessment frameworks to ensure efficacy and safety.

Challenges and considerations for policymakers

Despite the opportunities presented by digital mental health interventions, this systematic review emphasizes the challenge of potential digital exclusion. Policymakers in the UAE need to address this concern by implementing strategies that ensure equitable access to technology and digital literacy using initiatives focused on bridging the digital divide, especially among vulnerable populations [138].

The review highlights concerns related to privacy and confidentiality in the use of digital mental health services. Fortunately, the UAE government has already issued standards for telehealth services in the country to ensure the quality, safety, and effectiveness of telehealth interventions [139, 140]. These standards delineate key areas of telehealth, including teleconsultation, telediagnosis,

telemonitoring, mHealth, telerobotics, and telepharmacy. New innovative digital mental health services should be developed with robust data protection regulations to safeguard users' privacy and align with the existing guidelines and standards.

User acceptance and resistance to technology-mediated interactions are significant challenges identified in the review. Incorporating user-centric design principles in the development and implementation of digital mental health interventions is recommended as user feedback mechanisms, ongoing education, and awareness campaigns can contribute to fostering positive attitudes towards technology-enabled mental healthcare [141]. An essential consideration for policymakers is the integration of digital mental health services with traditional in-person services. Hybrid models that seamlessly blend technology-enabled interventions with existing mental health infrastructure could be explored [142].

Recommendations for policymakers and stakeholders

Policymakers should consider adopting and scaling the digital mental health platforms and modalities identified as effective in this review. Also, the integration of digital mental health services with existing in-person care is essential. Hybrid models that blend digital and traditional services should be explored to provide comprehensive mental health support. Such models can address varying patient needs and preferences, ensuring that no population is left underserved. Addressing the digital divide is crucial for the equitable implementation of digital mental health interventions. Initiatives focused on improving digital literacy, particularly among vulnerable and underserved populations, should be prioritized. Given the sensitive nature of mental health data, it is imperative that new digital health services are developed in compliance with robust data protection regulations. Policymakers should ensure that all digital interventions align with existing telehealth standards in the UAE, safeguarding patient privacy and maintaining the integrity of mental health services. More importantly, to maintain the efficacy and safety of digital mental health interventions, ongoing evaluation and research are necessary.

Limitations

One of the strengths of this study is the comprehensive approach to reviewing a wide array of digital mental health interventions across various platforms and patient populations, which lays a robust foundation for informing mental health system strengthening interventions. However, there are several limitations to consider; the study is limited by restricting the review to English-language publications, which may exclude relevant studies published in other languages. Moreover, there is a potential publication bias as the review primarily included

open-access articles. Furthermore, the rapid evolution of digital technologies means that some of the reviewed interventions may become outdated quickly, necessitating ongoing research to keep up with technological advancements.

Conclusion

This systematic review provides a valuable evidence base for policymakers and mental health stakeholders in the UAE to navigate the landscape of digital mental health interventions. By capitalizing on the identified opportunities, addressing challenges, and implementing targeted recommendations, policymakers can contribute to the strengthening of the mental health system in the UAE. The integration of digital technology has the potential to revolutionize mental health care delivery, making it more accessible, flexible, and responsive to the diverse needs of the population. Through strategic and informed decision-making, the UAE can position itself at the forefront of leveraging digital innovation for mental health system development.

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12889-024-19980-y>.

Supplementary Material 1

Supplementary Material 2

Supplementary Material 3

Supplementary Material 4

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Author contributions

RA conceptualized the study and consensus on methodology and registration was done by RA and YAME. Defining keywords for the search was done by BI, YAME, and RA. Database search was done by BI and YAME. The first tier of title and abstract screening was done by YAME, HS, RK, and RA second tier of title and abstract screening was done by DE, NSS, TM, and NK. Full-text screening and checking eligibility criteria were done by YAME, HS, NK, TM, AO, and KM. Data extraction was done by YAME, NSS, RK, AE and reassessed by RA, TM. Qualitative analysis was done by YAME. Data analysis and quality appraisal were done by YAME, TM, NK, TA and reviewed by RA. The introduction, methodology, discussion, and conclusion were drafted by YAME and RA. RA, RK, NSS, DE and YAME have reviewed the article and provided input. All co-authors approved the final version of the manuscript.

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Data availability

All data generated or analyzed during this study are included in this published article and its supplementary information files.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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