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Review article

Digital Health Disparities: A Review of Barriers and Solutions for Racially Diverse Groups

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ABSTRACT

Background: Digital health applications have transformed healthcare delivery by offering convenient, cost-effective means of managing chronic diseases and promoting wellness. However, racially diverse groups experience substantially lower adoption and utilisation rates compared to majority populations, revealing underlying challenges that perpetuate healthcare disparities.

Objective: This narrative review examined barriers affecting adoption and utilisation of digital health apps among racially diverse groups and explored evidence-based strategies to improve engagement and ensure equitable access.

Method: A comprehensive literature search was conducted across PubMed, Scopus, Web of Science, and Google Scholar for peer-reviewed articles published between January 2010 and June 2024. Studies examining digital health app usage among racially diverse populations that discussed barriers, facilitators, or strategies for improving adoption were included. Codebook thematic analysis was employed to synthesise findings and identify recurring patterns across 38 included studies.

Results: Analysis of 38 studies revealed that digital health app adoption among racially diverse groups is significantly hindered by multifaceted barriers. Socioeconomic constraints, limited digital literacy, cultural and linguistic mismatches, and trust concerns regarding data privacy were the most common barriers. Evidence-based strategies include developing culturally tailored applications, implementing community-based digital literacy training programmes, establishing transparent data privacy practices, and fostering collaborations with trusted community organisations.

Conclusion: Four key barrier categories: socioeconomic constraints, digital literacy limitations, cultural and linguistic mismatches, and trust concerns significantly impede digital health app adoption among racially diverse groups. Addressing these requires targeted, multidisciplinary interventions involving app developers, healthcare providers, and policymakers to ensure digital health applications are inclusive and accessible, ultimately reducing healthcare disparities.

1. Introduction

Digital health applications have transformed healthcare delivery by offering individuals convenient, cost-effective means of managing chronic diseases, accessing medical information, and promoting wellness. The rapid evolution of digital health technologies, including the emergence of large language models (LLMs) as chatbots and digital assistants in medical settings, demonstrates both promise and potential for

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exacerbating existing disparities if not properly designed with cultural considerations [1]. This shift aligns with global health strategies that increasingly emphasise preventive care, self-management, and empowerment through digital means [2,3].

In this context, "digital health apps" refers specifically to mobile health applications (mHealth apps) designed for smartphones and tablets that support health monitoring, disease management, health education, and wellness promotion. This definition excludes web-based platforms, wearable-only devices, and telehealth systems unless integrated within mobile applications. Digital health apps are especially significant for racially diverse groups who experience traditional barriers to healthcare, as they have the potential to bridge systemic gaps in healthcare access. These apps extend healthcare resources into settings where physical healthcare services may be limited, inaccessible, or expensive [1,4,5]. For historically underserved populations, digital health apps can facilitate consistent self-monitoring, provide easy access to health information, and connect users with healthcare providers [2].

However, whilst global digital health app adoption has broadened healthcare accessibility for many, data indicate that racially diverse groups often experience lower adoption and utilisation rates compared to majority populations. This discrepancy reveals underlying challenges specific to these communities and underscores the importance of examining factors that may inhibit their use of digital health tools [6]. Understanding these barriers is essential for creating equitable healthcare solutions that can meaningfully reduce health disparities. Many racially diverse groups experience socioeconomic constraints, such as lower incomes and limited access to technology, which directly impact their ability to use digital health apps. These financial limitations often restrict access to smartphones, internet connectivity, and data plans essential for accessing health apps [7–9].

Digital literacy varies significantly within and between racially diverse communities, affecting their ability to understand and navigate digital platforms effectively. Language and cultural differences present additional challenges, as many health apps are developed in dominant languages or cultural frameworks that may not align with racially diverse users' values, health beliefs, or communication preferences [10,11]. Trust issues also play a critical role, as concerns about data privacy and general distrust of technology are more pronounced among certain ethnic minority groups, especially when combined with fears of surveillance and discrimination [12,13].

This review was undertaken to synthesise current evidence on barriers to digital health app adoption among racially diverse groups and to identify effective strategies for promoting equitable access. By examining existing literature, we aim to provide actionable recommendations for stakeholders including app developers, healthcare providers, and policymakers. The aim of this narrative review is to examine barriers to adoption and utilisation of digital health apps among racially diverse groups and to identify effective strategies for increasing engagement with these tools.

Research Question

What are the barriers and facilitators to the adoption of digital health apps among racially diverse groups, and how can these challenges be addressed to promote equitable healthcare access?

Objectives

To identify and analyse socioeconomic, cultural, linguistic, and technological barriers to digital health app adoption in racially diverse groups.

To evaluate strategies and interventions aimed at overcoming these barriers, including culturally tailored solutions and community-based approaches.

To provide evidence-based recommendations for improving engagement with digital health apps in underserved populations.

2. Methodology

2.1. Search strategy and information Sources

This narrative review was conducted to synthesise evidence on barriers to digital health app adoption and strategies to enhance engagement among racially diverse, minority ethnic groups. The search strategy was developed following established guidelines for narrative literature reviews, with particular attention to transparency and reproducibility.

A comprehensive literature search was conducted across four major electronic databases: PubMed (via MEDLINE), Scopus, Web of Science, and Google Scholar. These databases were selected for their extensive coverage of peer-reviewed research in healthcare, digital health, public health, and health informatics. The search period covered studies published between January 2010 and June 2024, chosen to capture the evolution of digital health technologies and their adoption patterns.

Search terms were derived from a preliminary scoping review of the literature and combined using Boolean operators. Boolean operators were applied as follows: AND was used to combine different concept groups (e.g., digital health AND minority groups), whilst OR was used within concept groups to capture synonymous terms (e.g., "racially diverse" OR "ethnic minorities"). The search operators were applied consistently across all databases, with minor syntax adjustments made to accommodate database-specific requirements. The primary search strategy included the following keyword combinations:

- "digital health apps" AND ("minority ethnic groups" OR "racially diverse" OR "ethnic minorities" OR "racial minorities")
- "mobile health" OR "mHealth" AND ("health disparities" OR "digital divide" OR "healthcare equity")
- "digital health technology" AND ("cultural tailoring" OR "culturally adapted" OR "community-based interventions")
- "health apps" AND ("barriers" OR "facilitators" OR "adoption" OR "engagement") AND ("ethnic" OR "racial" OR "minority")

Additional search terms related to specific concepts were included: "digital literacy," "socioeconomic factors," "privacy concerns," "trust in technology," "language barriers," and "cultural competency." Reference lists of included articles were manually searched to identify additional relevant studies (pearl growing technique).

2.2. Inclusion and exclusion criteria

Studies were included if they were peer-reviewed publications focusing on digital health app usage among racially diverse or minority ethnic groups; discussed barriers, facilitators, or strategies for digital health app adoption; were published between January 2010 and June 2024; were in English language; and included adult populations (18 + years). Studies were excluded if they were editorials, opinion pieces, conference abstracts, or non-peer-reviewed publications; did not specifically address barriers, facilitators, or strategies for digital health app adoption; were published outside the specified date range; were non-English publications; or focused exclusively on paediatric populations (<18 years).

2.3. Study selection and screening process

The study selection process followed a systematic approach across multiple stages. First, the primary author (JT) conducted the initial search across all four databases using the predetermined search strategy. Search results were exported to a reference management system (EndNote X9) and duplicate records were removed. Second, two reviewers (JT and DBO) independently screened titles and abstracts of all retrieved records against the inclusion criteria. Any disagreements were resolved through discussion, and when consensus could not be reached,

a third reviewer (NL) was consulted. Third, full-text articles of potentially relevant studies identified during title and abstract screening were retrieved and assessed for eligibility by two reviewers independently. Reasons for exclusion at this stage were documented. Finally, reference lists of included studies were manually searched to identify additional relevant publications.

The comprehensive search strategy yielded 1,247 records across all databases (PubMed: 423, Scopus: 398, Web of Science: 287, Google Scholar: 139). After removing duplicates (n = 231), 1,016 unique records remained for title and abstract screening. Following this screening, 156 articles were deemed potentially relevant and retrieved for full-text review. Of these, 38 studies met the inclusion criteria and were included in the final narrative synthesis. Main reasons for exclusion during full-text review included lack of focus on racially diverse groups (n = 45), not addressing digital health apps specifically (n = 32), insufficient detail on barriers or facilitators (n = 28), study population outside inclusion criteria (n = 8), and methodological limitations or poor study quality (n = 5). Fig. 1 presents the PRISMA flow diagram illustrating the study selection process.

2.4. Data extraction and analysis

A structured data extraction template was developed and piloted. The following information was systematically extracted from each included study: study characteristics (author, year, country, study design), population demographics (sample size, age, ethnicity, socioeconomic status), digital health app type and functionality, identified barriers to adoption (categorised as socioeconomic, digital literacy, cultural/linguistic, trust-related), facilitators and strategies for improving engagement, and study outcomes and key findings.

Codebook thematic analysis was employed to synthesise findings across the included studies. This analytical approach involved developing a structured coding framework based on the study objectives, with predefined categories for barrier types (socioeconomic, cultural/linguistic, digital literacy, trust-related) and strategy types (culturally tailored solutions, community-based approaches, digital literacy training, privacy measures). Two reviewers (JT and DBO) independently applied the codebook to a subset of studies to ensure consistency, refining category definitions as needed. The analysis process included familiarisation with data through repeated reading of included studies, systematically coding barrier and strategy data into predefined categories, quantifying the frequency of each barrier category across studies, and synthesising findings within each thematic category to identify patterns and convergence in the literature. This deductive approach allowed for systematic comparison across studies whilst maintaining flexibility to capture nuances within each category.

2.5. Quality assessment

Whilst formal quality assessment using standardised tools (e.g., CASP, MMAT) was not conducted, this represents a significant limitation of this review. During data extraction, we noted methodological characteristics including study design, sample size, sampling approach, and clarity of reported findings. Studies with significant methodological limitations were interpreted with appropriate caution. The absence of formal quality appraisal means that studies of varying methodological rigour were given relatively equal weight in the synthesis, which may affect the strength of conclusions drawn.

3. Results

3.1. Contextual Background: Potential benefits of digital health apps

Digital health applications offer functionalities supporting health management, including tracking physical activity, monitoring dietary intake, managing medications, and communicating with healthcare providers [10,11]. Key potential benefits identified include improved access to health information, continuous health monitoring, enhanced self-management, reduced healthcare stigma, and culturally relevant guidance (Table 1).

Apps provide easy access to health education and disease management resources tailored for diverse populations [14,15]. Wearable

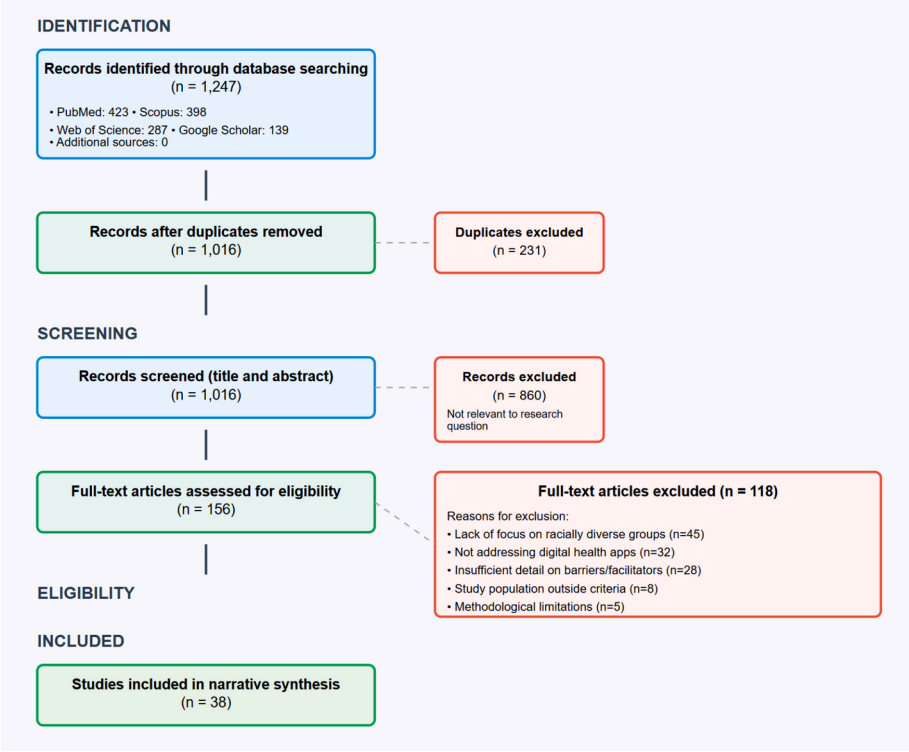

Fig. 1. PRISMA flow diagram for article selection.

Table 1
Key Benefits of Digital Health Apps for Racially diverse Groups.

Benefit	Description	Examples	Potential Impact	References
Improved Access to Health Information	Apps provide easy access to health education, preventive care guidelines, and disease management resources tailored for diverse populations.	Digital health apps offering culturally relevant information on chronic diseases like diabetes for South Asian communities.	Enhances health literacy and empowers individuals to make informed health decisions, potentially reducing chronic disease rates in underserved populations.	[13–15]
Continuous Health Monitoring	Apps and wearable devices allow users to track vital signs, physical activity, and symptoms, providing real-time health feedback.	Fitness trackers connected to health apps monitor cardiovascular health and prompt interventions as needed.	Facilitates early detection of health issues, reducing hospital visits and managing chronic diseases more effectively.	[13,16]
Self-Management and Independence	Apps enable users to manage conditions independently with reminders, progress tracking, and personalized recommendations.	Apps for managing asthma or hypertension provide medication reminders and alert users to abnormal metrics.	Reduces reliance on in-person healthcare visits, encourages adherence to health plans, and promotes self-efficacy in health management.	[17,18]
Reduced Healthcare Stigma	Apps provide private access to health information and support, minimizing the stigma around sensitive health issues.	Mental health apps allow for anonymous self-help tools, addressing mental health concerns in communities where stigma is prevalent.	Encourages engagement with mental and sexual health resources, promoting better health outcomes and reducing barriers to care for stigmatized conditions.	[19,20]
Culturally Relevant Health Guidance	Customizable features in some apps include culturally aligned health advice and tailored messaging.	"Heart Healthy Latino" app offers culturally relevant dietary guidance aligned with Latino food preferences.	Increases app relevance and engagement among minority groups, leading to better adherence to health recommendations and improved outcomes.	[21,22]

devices integrated with apps allow continuous monitoring of vital signs, facilitating early detection of health issues [13,16]. Apps enable independent condition management with reminders and personalised recommendations [17,18].

Importantly, apps provide private access to health information, minimising stigma around sensitive issues, particularly valuable for mental health support where stigma is prevalent [19,20]. Wells et al. [23] found that Hispanic and African American participants using the "Together for Wellness" digital mental health platform reported high engagement, particularly valuing privacy and accessibility of anonymous resources. Customisable features in some apps include culturally aligned advice, such as the "Heart Healthy Latino" app offering dietary guidance aligned with Latino food preferences [21,22].

However, realising these benefits requires addressing significant barriers that currently limit adoption. Fig. 2 provides visual representation of these multifaceted barriers.

3.2. Barriers to digital health app adoption

Analysis of 38 studies revealed four primary barrier categories presented below with their frequency of occurrence. Table 2 summarises barriers with their frequency across studies.

Table 2
Barriers to Digital Health App Adoption Among Racially Diverse Groups.

Barrier Category	Key Manifestations	Example Studies
Socioeconomic Constraints	Inability to afford smartphones or data plans; lack of reliable internet; inability to afford subscriptions; limited resources for technology maintenance	[24–27]
Digital Literacy Limitations	Low familiarity with smartphone interfaces; difficulty navigating apps; limited confidence in technology; generational gaps in digital skills	[28–31]
Cultural and Linguistic Mismatches	Apps only in dominant languages; health messaging not aligned with cultural beliefs; lack of culturally relevant information; poor translation quality	[6,32–35]
Trust and Privacy Concerns	Fear of data breaches or misuse; concerns about surveillance; historical mistrust of healthcare systems; lack of transparency in data handling	[7,36–38]

3.2.1. Socioeconomic barriers

Socioeconomic constraints were identified as the most frequently reported barrier. Racially diverse groups often experience higher poverty rates and lower educational attainment, affecting their ability to purchase and maintain necessary technology [24,25].

Senecal et al. [27] found that Black and Hispanic participants' usage of workplace digital health tools was more strongly associated with income levels compared to Caucasians, suggesting lower income exacerbates disparities in app engagement for minority groups. Smartphone ownership remains lower among low-income households, with notable disparities among Hispanic and Black populations [26].

Beyond device ownership, barriers extend to subscription fees for advanced apps and high-speed internet access necessary for effective functionality [13,24].

3.2.2. Digital literacy and technological access

Limited digital literacy was also identified. Many individuals, particularly older adults, those with lower educational levels, and recent immigrants, lack familiarity with smartphones and digital platforms

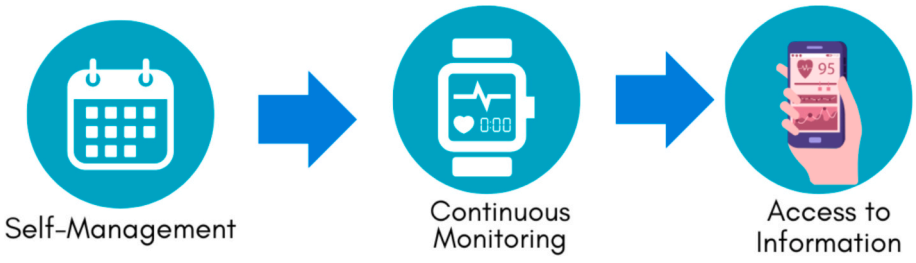

Fig. 2. Benefits of Digital Health Apps for Racially diverse Groups. The figure visually communicates how digital health apps can overcome traditional healthcare access challenges by providing personalized, continuous, and culturally sensitive health management tools for racially diverse communities.

required to navigate health apps [29,30].

Kumar et al. [28] found that although most participants in an underserved US patient population owned mobile phones, only 28 % of smartphone owners actively used health apps, with limited comfort and confidence in using mobile health features.

Technological access is not uniformly distributed, particularly in rural or underserved urban areas. Bell et al. [31] demonstrated that rural and low-income communities are less likely to have high-speed internet essential for digital health services requiring real-time data sharing.

3.2.3. Cultural and linguistic barriers

Many apps are designed without accounting for unique health beliefs, values, and communication preferences of diverse populations [6,34,39]. Many apps are available exclusively in majority languages, limiting accessibility for those more comfortable in native languages [6,33]. Rodriguez et al. [32] highlight that health information is best understood in one's primary language; however, their study does not provide specific implementation guidance.

Even among those fluent in dominant languages, cultural barriers impact usability, as health beliefs and practices vary widely across cultures [35]. Health literacy levels also differ across ethnic groups, complicating health information communication [40,41].

3.2.4. Trust and privacy concerns

Among racially diverse groups, trust is often influenced by historical and ongoing experiences of systemic discrimination and marginalisation [7,36,37]. O'Loughlin et al. [42] found that 68 % of mental health apps had unacceptable transparency regarding data practices, with nearly half lacking privacy policies altogether. Benjumea et al. [43] found low GDPR compliance among apps for breast cancer patients, revealing gaps in communicating data handling practices. Ethnic minorities are more likely to report privacy and security concerns when using health apps compared to white populations [38].

3.3. Strategies to increase engagement

Analysis revealed four primary strategy categories shown to promote adoption and engagement. Fig. 3 provides a visual framework of these interconnected strategies.

3.3.1. Culturally tailored applications

Apps integrating language options and health information relevant to specific ethnic backgrounds prove more effective [10,11,44,45].

Jain et al. [46] developed "Happy Heart," a bilingual Hindi-English app for coronary artery disease patients in India with culturally tailored educational content, which received high satisfaction ratings during

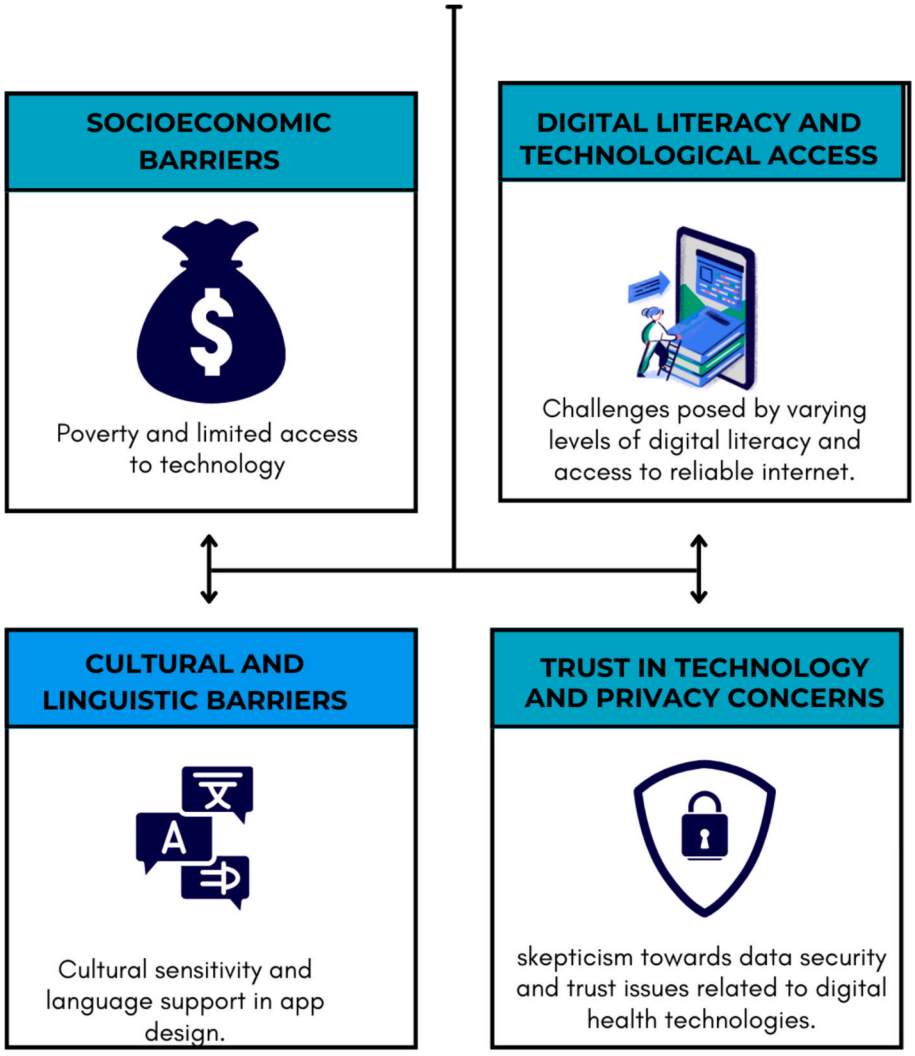

Fig. 3. Barriers to Digital Health App Adoption Among Racially Diverse Groups: A Comparative Analysis. The figure presents a visual representation of the various barriers that hinder the adoption of digital health apps among racially diverse groups. It is organized into distinct segments, each highlighting a specific challenge faced by these communities.

pilot phase. Apps promoting cardiovascular health in African American communities incorporated culturally relevant dietary advice aligning with traditional food preferences whilst offering healthier alternatives [47,48].

3.3.2. Community-Based approaches

Involving trusted community figures. such as community health workers, religious leaders, and educators, helps bridge gaps between technology and healthcare [47,49].

Li et al. [50] demonstrated that a community health worker-led initiative introducing a diabetes management app in rural African American communities led to higher adoption and sustained use compared to promotion through traditional healthcare channels. Community-led efforts provide ongoing support, helping users navigate technological challenges [41,51].

3.3.3. Digital literacy education

Programmes providing basic training on smartphone use, app navigation, and data management prove transformative [52].

Programmes delivering instruction in multiple languages with hands-on, step-by-step guidance are especially beneficial for those with limited English proficiency or unfamiliar with digital devices [53,54]. Evidence supports that digital literacy training improves confidence in using health apps and empowers users to make better health decisions [13,55,56].

3.3.4. Addressing privacy and trust concerns

Addressing concerns requires transparent communication about data usage and protection [57,58]. Partnering with trusted community organisations to promote apps reinforces credibility and alleviates privacy concerns [59]. Islam & Patel [49] suggest that racially diverse groups are more likely to trust health apps when promoted by familiar and respected community leaders.

Fig. 3 summarizes the multifaceted barriers faced by racially diverse groups in utilizing digital health apps. Furthermore, some racially diverse groups fear that data shared on digital health platforms could lead to discrimination, whether in healthcare or other areas, such as employment or insurance. Addressing these privacy concerns through transparent communication, strong data protection measures, and community engagement can be pivotal in building trust and encouraging app usage among this population [60].

3.4. Illustrative case examples

Two exemplar cases illustrate effective application of identified strategies:

The mHealth programme in Kenya focused on improving maternal health outcomes in rural, low-income women [61,62]. Developers integrated local languages and culturally relevant practices. Community health workers introduced and guided users through the app. This approach resulted in substantial increases in maternal health service utilisation and improved health outcomes.

The Heart Healthy Latino app in the United States addressed language and cultural barriers by providing health education in Spanish tailored to cardiovascular health risks prevalent in Latino populations [47]. The app included culturally relevant dietary recommendations featuring healthy adaptations of traditional Latino foods. Collaboration with community health workers who provided continuous support led to increased usage and positive health behaviour changes.

Table 3 below highlights key case studies of effective digital health app interventions.

4. Discussion

4.1. Principal findings

This narrative review synthesised evidence from 38 studies examining barriers to digital health app adoption among racially diverse groups and strategies to improve engagement. The analysis revealed four key barrier categories affecting adoption: socioeconomic constraints, digital literacy limitations, cultural and linguistic mismatches, and trust and privacy concerns. Correspondingly, four primary strategies showed effectiveness: culturally tailored applications, community-based approaches, digital literacy education, and privacy-enhancing measures.

The high frequency of socioeconomic barriers underscores that financial constraints remain fundamental obstacles to digital health equity. This aligns with broader literature on social determinants of health, where economic disadvantage compounds healthcare access inequities. The finding that over half of studies identified socioeconomic barriers suggests that technological solutions alone are insufficient without addressing underlying economic disparities.

Digital literacy emerged as a critical barrier in half of studies, highlighting that device ownership does not guarantee meaningful engagement. Kumar et al.'s [28] finding that only 28 % of smartphone owners in underserved populations actively used health apps demonstrates the gap between access and utilisation. This emphasises the need for comprehensive digital skills training beyond basic device operation.

Table 3
Case Studies Demonstrating Effective Digital Health App Interventions.

Case Study	Location/Population	Intervention Description	Outcomes	References
mHealth Program	Kenya; Rural, low-income women	Used mobile health apps to provide maternal health information in local languages, with support from community health workers.	Increased maternal health service utilization, higher rates of prenatal care attendance, and improved maternal and child health outcomes.	[61]
Heart Healthy Latino	United States; Latino communities	Spanish-language app providing cardiovascular health education, behavior change tools, and culturally relevant dietary advice, supported by community health worker partnerships.	Improved cardiovascular health behaviors among Latino users, with increased dietary adherence and higher engagement due to community health worker support.	[47]
Text4baby	United States; Low-income, ethnically diverse pregnant women	Mobile messaging service offering health tips and reminders for prenatal and infant care, accessible in both English and Spanish.	Higher prenatal care attendance and improved health knowledge in underserved populations, with reduced health disparities in maternal and child health.	[63]
Sustainable East Africa Cardiovascular Health Initiative (SEACHANGE)	East Africa; Adults at risk of cardiovascular disease (CVD)	Delivered CVD education and health tracking through an app tailored to local dietary practices and health challenges, supported by healthcare providers.	Increased physical activity, improved dietary habits, and lower blood pressure levels among participants, highlighting the impact of culturally tailored interventions on CVD management.	[64]
My Diabetes My Way	Scotland; Ethnically diverse communities with higher prevalence of diabetes	Online portal and mobile app providing diabetes self-management resources and educational content tailored for minority groups.	Improved diabetes control and knowledge, with significant engagement among minority groups, resulting in reduced hospitalizations and better disease management outcomes.	[65]

4.2. Interpretation of findings

The intersection of cultural, linguistic, and trust-related barriers reveals that effective digital health solutions for racially diverse groups must extend beyond translation to encompass deep cultural adaptation. Rodriguez et al. [32] identified the importance of primary language presentation, yet implementation guidance remains limited. This gap between recognising the need for cultural tailoring and practical implementation represents a critical area for future development.

Trust and privacy concerns, identified in 42 % of studies, reflect historical and ongoing experiences of systemic discrimination. The findings from O'Loughlin et al. [42] and Benjumea et al. [43] regarding inadequate transparency and privacy policies in health apps demonstrate that user concerns are well-founded. This suggests that building trust requires substantive changes in data governance practices, not merely improved communication.

The success of community-based approaches illustrated in the Kenya mHealth programme and Heart Healthy Latino app demonstrates that trusted intermediaries can effectively bridge technological and cultural divides. These case examples show that combining multiple strategies, cultural tailoring, community engagement, and ongoing support produces better outcomes than isolated interventions.

4.3. Implications for Practice and Policy

For app developers, findings emphasise the necessity of incorporating racially diverse users throughout the design process, from initial concept through testing and refinement. Cultural tailoring must extend beyond superficial translation to include culturally appropriate imagery, examples, health messaging, and functionality aligned with diverse health beliefs and practices.

For healthcare providers and public health practitioners, community-based implementation approaches show promise for increasing adoption. Partnerships with trusted community organisations, religious institutions, and community health workers can facilitate introduction of digital health tools whilst providing ongoing support that addresses both technical and cultural barriers.

For policymakers, findings highlight the need for interventions addressing digital infrastructure disparities, particularly in rural and low-income areas. Policies supporting affordable internet access, subsidised devices for low-income populations, and digital literacy programmes in community settings could reduce socioeconomic barriers significantly.

For privacy and data governance, findings call for stronger regulatory frameworks ensuring transparency in health app data practices, with particular attention to making privacy policies accessible and understandable to users with varying literacy levels and language preferences.

4.4. Strengths and limitations

This review's strengths include comprehensive searching across four major databases, systematic screening process with independent dual review, and quantitative reporting of barrier and strategy frequencies providing empirical foundation for conclusions. The narrative synthesis approach allowed integration of diverse study designs and contexts.

However, several limitations should be acknowledged. The narrative approach allows for subjective interpretation compared to systematic reviews with *meta*-analysis. The absence of formal quality assessment using standardised tools means studies of varying methodological rigour were given relatively equal weight, potentially affecting conclusion strength. The restriction to English-language publications may have excluded relevant studies in non-English contexts where many minority ethnic communities are studied.

The search was conducted in March 2025, and given rapid evolution of digital health technologies, newer studies may have emerged. However, our comprehensive search and inclusion of 38 studies provides robust evidence base. The heterogeneity of included studies across contexts, populations, and methodologies limits ability to draw universally applicable conclusions. Barriers and strategies may not apply equally across all racial and ethnic minorities, and effectiveness may vary based on local contexts.

4.5. Future research Directions

Future research should focus on: (1) systematic reviews with formal quality appraisal using standardised tools (e.g., CASP, MMAT) to strengthen evidence quality; (2) longitudinal studies examining long-term impacts of digital health apps on health outcomes, behaviours, and engagement patterns in racially diverse groups; (3) comparative effectiveness research evaluating different intervention strategies through rigorous experimental designs, particularly randomised controlled trials; (4) investigating how emerging technologies such as AI-powered chatbots and LLMs can be culturally adapted to serve diverse populations without exacerbating disparities; (5) implementation science approaches examining how to scale successful interventions across diverse settings and populations whilst maintaining fidelity to core principles; and (6) participatory research involving racially diverse communities as co-designers of digital health solutions from inception through evaluation.

5. Conclusion

This narrative review of 38 studies identified four key barrier categories significantly impeding digital health app adoption among racially diverse groups: socioeconomic constraints, digital literacy limitations, cultural and linguistic mismatches, and trust concerns. The prevalence of these barriers demonstrates their pervasive and interconnected nature, requiring coordinated, multifaceted responses rather than isolated interventions. Addressing these barriers requires comprehensive strategies operating at multiple levels: culturally tailored applications incorporating multilingual support and culturally relevant content designed with input from target communities; community-based implementation involving trusted intermediaries such as community health workers and religious leaders; digital literacy education programmes delivered in accessible community settings; and transparent data privacy practices with clear, accessible policies and robust data protection measures.

Specific recommendations for key stakeholders include: app developers should engage racially diverse communities as co-designers throughout the development lifecycle, conduct usability testing with target populations, and implement transparent data handling practices; healthcare providers and public health practitioners should partner with trusted community organisations to introduce and support digital health tools whilst integrating them into existing community health programmes; policymakers should invest in digital infrastructure in underserved areas, develop subsidy programmes for devices and data plans for low-income populations, fund community-based digital literacy programmes, and establish regulatory frameworks ensuring transparency in health app data practices; and researchers should conduct rigorous systematic reviews with formal quality appraisal, pursue longitudinal studies examining sustained engagement and health outcomes, evaluate comparative effectiveness of different intervention strategies, and engage in participatory research with racially diverse communities as equal partners.

Achieving digital health equity requires recognising that technology alone is not the solution; rather, it is how technology is designed, implemented, and supported within specific cultural and socioeconomic contexts that determines whether it reduces or reinforces health disparities. Collaboration among app developers, healthcare providers, policymakers, researchers, and minority communities is critical to ensuring digital health solutions are accessible and responsive to unique

needs of diverse populations. Without such collaborative, equity-focused approaches, digital health innovations risk widening rather than closing existing healthcare gaps. The COVID-19 pandemic highlighted both the potential of digital health tools to extend care access and the dangers of digital exclusion for already marginalised populations. By addressing the four key barrier categories through coordinated, culturally responsive, community-engaged strategies informed by this evidence synthesis, we can harness the transformative potential of digital health apps to improve health outcomes for racially diverse populations and contribute to a more equitable healthcare landscape for all.

Ethics approval and consent to participate: This study did not involve human or animal subjects, and thus, no ethical approval was required

CRediT authorship contribution statement

Jennifer Teke: Conceptualization, Formal analysis, Investigation, Methodology, Validation, Writing – original draft, Writing – review & editing. **David B. Olawade:** Conceptualization, Formal analysis, Investigation, Methodology, Project Administration, Writing – original draft, Writing – review & editing. **Navami Leena:** Investigation, Methodology, Writing – original draft, Writing – review & editing. **Kusal Weerasinghe:** Investigation, Methodology, Writing – original draft, Writing – review & editing. **Siobhan Mc Lernon:** Investigation, Methodology, Writing – original draft, Writing – review & editing. **Calvin Moorley:** Investigation, Methodology, Supervision, Writing – original draft, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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