A Scoping Review of the Effectiveness of mHealth Interventions for Asthma Self-Management in African American Adolescents and Emerging Adults

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ABSTRACT

Background: Asthma remains one of the highly prevalent chronic lower respiratory diseases in the United States, affecting 24.9 million Americans. African Americans constitute the second most affected ethnic group in the U.S., accounting for 10.9% (4.2 million) of all cases.

Objective: A comprehensive scoping review was conducted to identify trends and gaps about the effectiveness, feasibility, and user-experience of mobile health (mHealth) interventions for asthma self-management, specifically targeting African American adolescents and emerging adults, a demographic disproportionately burdened by asthma morbidity and mortality.

Material & Methods: A systematic search strategy was executed across three major electronic databases (PubMed, Scopus, and CINAHL) to identify peer-reviewed literature published between 2012 and 2021. Eligibility criteria included studies focusing on African American adolescents (ages 10–19) and emerging adults (ages 18–29) with a diagnosis of asthma, utilizing mHealth technologies. The review adhered to the PRISMA-ScR guidelines.

Results: The search yielded an initial 462 records, of which 52 full-text articles were assessed for eligibility. A final set of 13 studies met the inclusion criteria. The aggregate sample represented a diverse range of study designs: 4 randomized controlled trials, 5 pilot/feasibility studies, 3 qualitative assessments, and 1 systematic review. Synthesis of the data indicates that mHealth interventions are largely feasible and acceptable within this population. While significant improvements in medication adherence and self-efficacy were reported in several studies, there was no significant reduction in acute healthcare utilizations.

Conclusion: mHealth interventions present a viable, scalable strategy to mitigate health disparities among African American youth with asthma. However, the translation of behavioral improvements into long-term clinical outcomes remains a challenge. Future research designs must pivot towards large-scale, longitudinal RCTs integrating social determinants of health to maximize mHealth clinical utility.

Keywords: Asthma, African American Adolescents, Emerging Adults, Mobile Health, Self-Management.

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Introduction

The Epidemiology of Disparity in Asthma

Asthma is characterized as one of the highly prevalent chronic lower respiratory diseases in the United States. It affects 24.9 million Americans, or 7.7% of the population, as of 2025.[1] Children are categorized as being at the highest risk. Specifically, 6.5% of American children aged 18 and younger and 8% of American adults aged 18 and older are affected by asthma.[2] During an asthma attack, the muscles surrounding the patient's airways tighten and become extremely narrow, resulting in significant difficulty breathing.

Racial disparities are highly evident in asthma prevalence and outcomes.[3] African Americans

constitute the second most affected ethnic group in the U.S., accounting for 10.9% (4.2 million) of all cases, surpassed only by American Indian/Alaskan Natives (12.3%, 566 million).[1] These statistics are not merely reflections of biological susceptibility but are deeply entrenched in the social determinants of health (SDOH) and structural inequities that define the lived experience of many African American youths. The disparity is further noticed when examining the transition from adolescence to emerging adulthood (ages 18–29). This developmental stage is critical; it is characterized by a shift in responsibility for disease management from the caregiver to the individual.[3]

African Americans are also 4.5 times more likely to be hospitalized for asthma and 7.1 times more likely to die from it annually compared to White Americans, indicating severe disparities in asthma control (Ebell et al., 2019). Furthermore, financial barriers significantly impede self-management, as more than one in five families cannot afford asthma medicines.[5] As many as 62.4% of African American children who suffered an asthma attack ended up visiting the emergency room (ER).[6] Also, African American emerging adults are more likely to reside in urban environments characterized by higher concentrations of environmental allergens, such as particulate matter and indoor pests, which exacerbate respiratory pathology.[4] As of 2023, chronic lower respiratory diseases, including asthma, remain the fifth leading cause of death in the United States.[1]

The Technological Paradigm: mHealth as an Equalizer

In response to these persistent disparities, mobile health (mHealth) has emerged as a potent modality for intervention. mHealth is defined as the utilization of wireless and mobile devices to improve healthcare, health research, and health outcomes.[7] mHealth applications include using smartphones and tablets to provide preventative services, collecting clinical and community health data, delivering healthcare information, monitoring patient vital signs in real-time, and managing chronic diseases. mHealth is a rapidly developing field that is gaining popularity in underserved areas and plays an integral role in facilitating adherence to medications and other asthma treatment plans.[8-10]

mHealth interventions offer innovative approaches to enhancing asthma self-management by facilitating education and information exchange between patients and providers. mHealth leverages the ubiquity of mobile devices to bridge the gap between clinical recommendations and daily patient behavior.[11] For African American adolescents and emerging adults, who exhibit high rates of smartphone ownership and digital engagement, mHealth offers a culturally relevant and accessible platform for health promotion.[12]

The theoretical underpinnings of mHealth interventions in this context often draw from behavioral frameworks such as self-regulation theory and self-determination theory.[13-14] These frameworks posit that tools facilitating self-monitoring (e.g., symptom tracking), providing feedback (e.g., adherence visualization), and fostering relatedness (e.g., communication with providers) can enhance an individual's capacity to manage chronic illness. By delivering real-time, context-aware support, mHealth tools attempt to overcome the limitations of traditional, episodic clinical care.[12]

The Rationale and Purpose

Despite the promise of mHealth interventions, most previous studies have often aggregated data across heterogeneous populations, potentially obscuring the unique barriers and facilitators relevant to African American perspectives and experiences.[15-16] For example, issues of medical mistrust, privacy concerns regarding data sharing, and specific preferences for app aesthetics and functionality suggest that "one-size-fits-all" interventions may lack efficacy in this population.[17]

The risk factors, adherence patterns, and management strategies for asthma may differ for African Americans compared to other racial groups.[8] This population experiences poor health outcomes due to continuous health disparities. Furthermore, African Americans diagnosed with chronic lower respiratory diseases underutilize tertiary prevention services, such as pulmonary rehabilitation.[18] Therefore, the empirical evidence regarding its effectiveness specifically for African American adolescents and emerging adults requires systematic synthesis.

This scoping review aims to identify trends and gaps in the literature regarding the effectiveness of mHealth interventions in managing asthma in African American adolescents and emerging adults. By exploring several study designs, technological features, and clinical outcomes, this review seeks to answer critical questions regarding the feasibility, acceptability, and clinical impact of these digital tools. The subsequent analysis will provide a detailed examination of participant characteristics, highlighting the intersectionality of race, age, and socioeconomic status, and will evaluate the extent to which current interventions are successful in addressing the specific needs of this high-risk group.

The analysis will also focus on the effectiveness of mHealth interventions to promote behavioral change in this specific demographic, which we hope will lead to a better understanding of asthma trends and management across ethnic groups in the U.S. The strategies identified will help improve adherence to treatment regimens, improve provider-client communication, and facilitate follow-up on exacerbation triggers.[19]

The specific objectives of this scoping review are:

1. To identify the key components of efficient mHealth programs on asthma self-management in African American adolescents and emerging adults.
2. To explore the impact of mHealth interventions on clinical outcomes, self-efficacy, and quality of life.

Materials and Methods

Research Design and Framework

This review employed a scoping review methodology, a rigorous approach designed to map the key concepts underpinning a research area and the main sources and types of evidence available. This methodology is particularly appropriate for the emerging field of mHealth, where study designs are diverse, and the technology evolves rapidly. It was helpful to identify trends and gaps in the literature about the effectiveness of mHealth interventions in managing asthma in African American adolescents and emerging adults. We focused on African Americans as the population of interest who experience disparities in using mHealth interventions to manage asthma symptoms.[18] This study utilized secondary data and was therefore exempt from ethical clearance review.

We adhered to the Preferred Reporting Items for Systematic Reviews (PRISMA) protocol.[20] to extract and synthesize data. The PCC (Population, Concept, and Context) approach by the Joanna Briggs Institute (JBI) was used to frame the study:

- Population: African American adolescents (ages 10-19) and emerging adults (ages 18-29).
- Concept: The effectiveness of mHealth interventions for asthma self-management.
- Context: The United States.

Search Strategy

A comprehensive search strategy was developed to identify relevant literature published between January 1, 2012, and October 30, 2025. This timeframe was selected to capture the proliferation of smartphone-based health interventions following the widespread adoption of modern mobile operating systems. The search was executed across several electronic databases, which initially included PubMed, MEDLINE, Web of Science, Cochrane Library, EMBASE, EBSCO Host, Scopus, and ProQuest, with Google Scholar used for additional electronic literature searches.

The search query utilized a combination of Medical Subject Headings (MeSH) and keywords. Terms related to the condition included "asthma," "wheeze," and "reactive airway disease." Intervention terms included "mHealth," "mobile health," "smartphone," "mobile app," "text messaging," "SMS," "self-management,", and "telemedicine." Population terms were specific to the demographic of interest: "African American," "Black," "adolescent," "teen," "youth," "emerging adult," and "young adult." Boolean operators (AND, OR) were used to combine these concepts effectively. Reference lists of relevant research articles were manually screened to identify additional eligible studies.[20]

Eligibility Criteria

Strict inclusion and exclusion criteria were applied to ensure the review focused on the specific intersection of mHealth, asthma, and the target demographic.

Inclusion Criteria

- Population: Studies explicitly targeting or including a significant sub-sample of African American adolescents (ages 10–19) and/or emerging adults (ages 18–29).
- Condition: Physician-diagnosed asthma.
- Intervention: Usage of mobile health technology, including smartphone apps, text messaging systems (SMS), or mobile-optimized web portals for self-management.
- Outcomes: Quantitative or qualitative data on asthma control, medication adherence, healthcare utilization (ED visits, hospitalizations), quality of life, or feasibility/acceptability.
- Language: English.

Exclusion Criteria

- Studies where the age range was exclusively children (<10 years) or older adults (>30 years).
- Studies that did not disaggregate data by race/ethnicity if the sample was mixed.
- General telemedicine interventions (e.g., video visits) without a mobile self-management component.
- Conference abstracts, editorials, and commentaries without primary data.

Selection Process

The selection process followed the PRISMA flow diagram structure as follows:

One independent reviewer screened the titles and abstracts of identified records and extracted data using a standardized form. Full-text articles were retrieved for all studies meeting the inclusion criteria. Data collected included study design, sample size, intervention components, duration, outcome measures, and key findings. Discrepancies were reviewed and resolved consistently.

Quality Assessment

Study quality was assessed using established tools: the Cochrane Risk of Bias Tool for randomized controlled trials and the Newcastle-Ottawa Scale for observational studies.

PRISMA Flow Diagram

The PRISMA flow diagram adheres to the PRISMA Extension for Scoping Reviews (PRISMA-ScR) guidelines.[20]

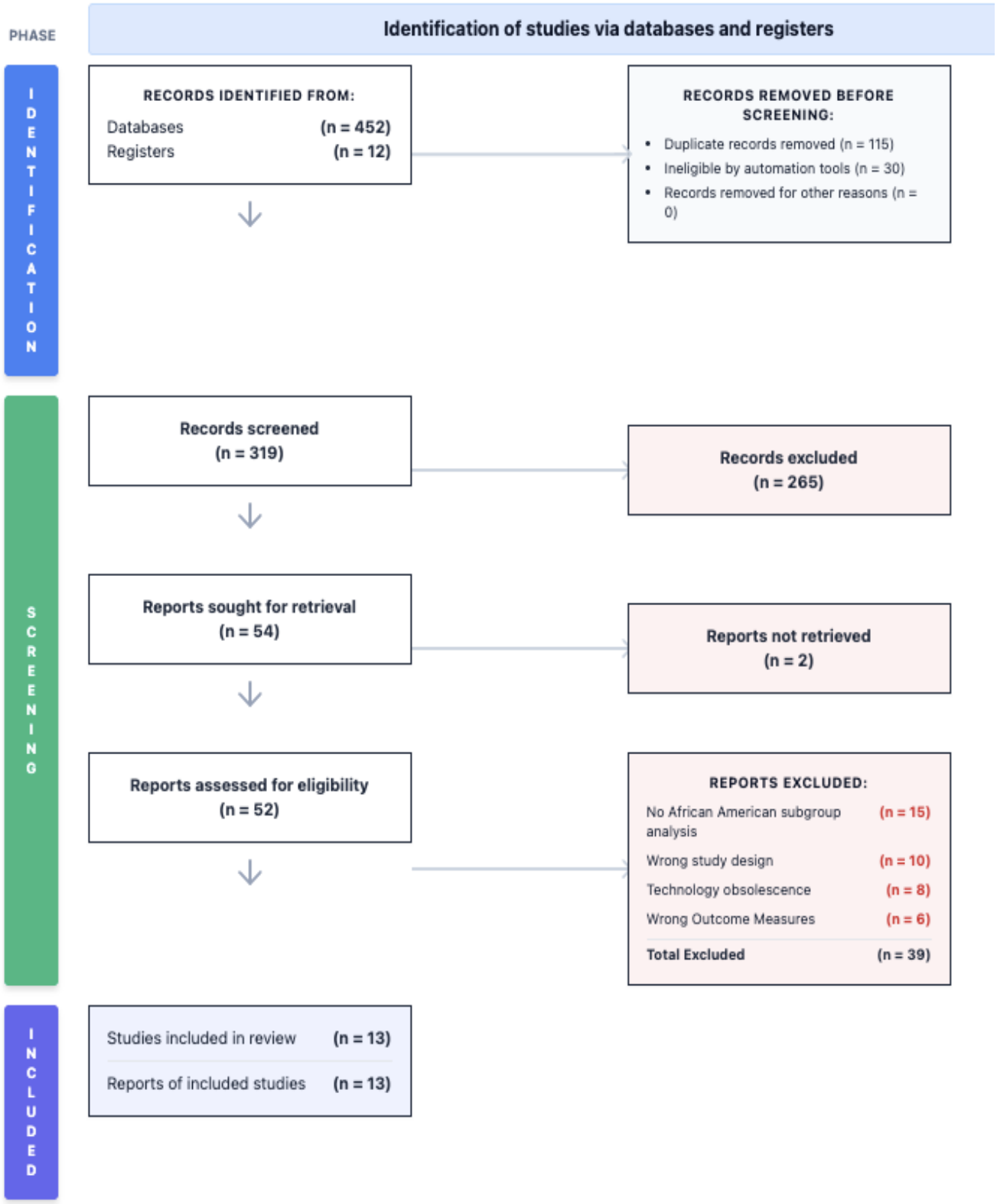

Figure 1: PRISMA Flow Diagram.

The initial database search identified 464 records. Following the removal of 145 duplicate records, 319 unique titles and abstracts were screened for relevance. This primary screening phase resulted in the exclusion of 265 records that clearly did not meet the eligibility criteria (e.g., wrong disease, wrong population).

The remaining 52 full-text articles were assessed for eligibility. During this phase, 39 articles were excluded for specific reasons:

- Not focused on African American population subgroup: 15 studies were excluded because they did not report results specific to African American adolescents or emerging adults or had negligible representation.
- Wrong study design: 10 studies were excluded due to not having appropriate study designs.
- Technology obsolescence: 8 studies were excluded due to not focusing on other technologies other than mHealth
- Wrong outcome measures: 6 studies were descriptive reviews or abstracts lacking empirical data on mHealth effectiveness or intervention outcomes.

Ultimately, 13 studies were included in the qualitative synthesis.

Data Extraction and Synthesis

Data were extracted using a standardized form capturing: author(s), year of publication, study location, study design and duration, sample size, participant demographics (age, race/ethnicity, sex), technology platform used, and key outcomes (asthma control, adherence, quality of life, tailored interventions, and patient-provider relationships). The synthesis involved a narrative approach, categorizing studies by intervention type and outcome to identify patterns and gaps in the evidence.

Study Characteristics and Demographics

Overview of Included Studies

The 13 included studies represent a decade of research (2012–2021) focused on leveraging technology to improve asthma outcomes in African American youth. Geographically, the studies were conducted entirely within the United States, with significant clusters in urban centers such as Rochester, NY; Detroit, MI; Charleston, SC; and Nashville, TN. This geographic distribution is consistent with the epidemiological prevalence of asthma in urban minority populations.

The study designs were heterogeneous, reflecting the developmental trajectory of the mHealth field. They included 4 randomized controlled trials (RCTs), 5 pilot or feasibility studies, 3 qualitative assessments (interviews/focus groups), and 1 systematic review that provided critical context on barriers and facilitators. The sample sizes ranged from small pilot groups (n=8) to larger cohorts (n=193), with study durations varying from single-day usability tests to 6-month clinical trials.

Participant Demographics

A critical strength of the selected studies is their robust representation of the target demographic. Several studies achieved high or exclusive enrollment of African American participants. One example is a study in Detroit with a 100% African American sample[22], and a Charleston-based pilot study, which reported a 93% African American participation rate.[23]

This high level of representation allows for a more accurate assessment of how mHealth tools interact with the specific cultural and socioeconomic contexts of African American youth. Many studies also noted that participants were largely from low-income households or were Medicaid beneficiaries, highlighting the inextricable link between race, poverty, and asthma disparities in the US healthcare system.

Table 1 Below provides a detailed breakdown of the design and participant characteristics for each included study.

Article	Location	Design/Duration	Sample size (N)	Patient age group	Racial/Ethnic Minority (%)	Sex (%)
Rhee et al. [24]	Rochester, NY, USA	Case-control design, 1 week with a 3-month follow-up	84 (Phase 1: 37, Phase 2: 84)	13-17	57% (Phase 1) African Americans	Males (57%, 21), Females (43%, 16)
Rhee et al. [25]	Rochester, NY, USA	Pilot feasibility study, 2 weeks	15	13-17	40% (6) African Americans	Males (60%, 9), Females (40%, 6)
Sage et al. [26]	NC, USA	Qualitative (Individual interviews) Usability test, 1 day	8	11-18	38% (3) African Americans	Males (50%, 4), Females (50%, 4)
MacDonell et al.[22]	Detroit, MI, USA	Pilot feasibility study, 14 days	16	18-25	100% (16) African Americans	Males (44%,7), Females (56%, 9)
Mulvaney et al.[27]	Nashville, TN, USA	Descriptive/Correlational, 1 month	53	12-18	64% (34) African American	Females (58%, 31), Males (42%, 22)
Ramsey et al.[17]	Cincinnati, OH, USA	Qualitative Interviews	20	12-17 (Mean 15.4)	50% (10) African American	Females (50%, 10), Males (50%, 10)
Miles et al.[28]	Multiple (Review)	Systematic Review	56 studies	Children, Adolescents, Adults	Included studies with AA populations	Varied across included studies
Teufel et al.[23]	Charleston, SC, USA	Pilot Feasibility Study, 2 months	14	8-16	93% (13) African American	Females (64%, 9), Males (36%, 5)

Hollenbach et al.[29]	Hartford, CT, USA	Pilot RCT	75	8-17 (Mean 12)	19% African American, 45% Latinx	Females (50%, 7 Male (50%, 7)
Stukus et al.[30]	Columbus, OH, USA	RCT, 6 months	193 (98 Intervention)	0.5-21	83% African American (Intervention)	Females (45%, 72), Males (55%, 88)
Johnson et al.[31]	Nashville, TN, USA	RCT, 3 weeks	89 (46 Intervention)	12-17	50% (23) African American	Females (52%, 24), Males (48%, 22)
Nichols et al.[14]	Charleston, SC, USA	Qualitative (Pilot), 2 months	19 dyads	8-16	84% (16) African American	Females (Phase 1: 64%), Males (Phase 1: 36%)
Fedele et al. al.[13]	Gainesville, FL / Lawrence, KS	Iterative Design (Qualitative), 15 months	20 (Interviews)	13-17	23% AA (UF site), 0% (KU site)	Females (54%, 3), Males (46%, 2)

Table 1. Study Design and Participant Characteristics.

Interventions and Technology Platforms

The Spectrum of mHealth Modalities

The review identified a diverse array of technological interventions, reflecting the rapid evolution of mobile capabilities over the study period. These can be broadly categorized into text messaging systems, smartphone applications (apps), and integrated sensor technologies.

Smartphone Applications

The most prevalent modality was the standalone smartphone application. Four specific studies utilized app-based interventions that formed a core group of evidence:[25] employed the mASMAA app;[30] utilized the AsthmaCare app;[13] developed the ReACT app; and[27] utilized a mobile system on an iPod Touch, which functionally served as an app ecosystem. These apps generally provided features such as symptom logging, educational modules, and medication reminders.

Integrated Sensor Technologies

Moving beyond manual entry, several studies incorporated objective data collection through sensors.[23] utilized the SAMS app integrated with Bluetooth-enabled inhaler caps. This system allowed for the passive recording of rescue and controller medication use, addressing the reliability issues associated with self-reported adherence. Similarly,[29] employed the HeroTracker sensor in conjunction with the BreatheSmart app, further validating the trend toward objective monitoring in clinical research.

Text Messaging (SMS)

SMS interventions, such as the MyMediHealth system[22,31] leveraged the ubiquity of basic mobile connectivity. These systems primarily focused on delivering reminders and collecting Ecological Momentary Assessment (EMA) data. The simplicity of SMS often translates to higher accessibility for lower-income participants who may not own the latest smartphones or have consistent data plans.

Tailoring and Theoretical Frameworks

A significant theme emerging from the analysis is the increasing sophistication of intervention

design, particularly regarding customization and theoretical grounding. Early interventions were often generic, but later studies explicitly incorporated behavioral theories.[13] grounded the *ReACT* app in self-regulation theory, designing features that promoted self-monitoring and self-reaction to specifically target barriers identified by adolescents. Similarly,[14] utilized self-determination theory to enhance autonomy and competence, recognizing that adolescents are more likely to engage with health behaviors when they feel a sense of ownership over the process.

A critical user preference was highlighted as African American adolescents explicitly rejected "one-size-fits-all" approaches.[17] They expressed a strong desire for tools that were customizable to their unique schedules and life circumstances, and importantly, they wanted the ability to share data directly with their healthcare providers to facilitate a partnership model of care.

Synthesis of Results on Asthma Outcomes

The effectiveness of mHealth interventions was evaluated across several domains: symptom control, medication adherence, quality of life, and healthcare utilization. Table 2 summarizes the specific outcomes reported by each study.

Article	Tech Platform	Asthma symptoms control/ACT scores	Treatment plan adherence	Improved quality of life	Tailored intervention	Enhanced patient-provider relationships	Outcomes
Rhee et al. [24]	Automated mobile device (ADAM) on iPod	Coughing, wheezing	Medication tracking and reminders (Automated)	Significance not clearly outlined	Medication usage visualization	Implicit via data sharing	Improved self-management; potential for automated monitoring.
Rhee et al. [25]	Smartphone app: mASMAA	Improved awareness of symptoms	Control medication reminders (Automated)	Not measured	Yes (Self-initiated)	Not explicitly measured	Promoted treatment adherence and sense of control.

Sage et al. [26]	App Wireframe (Usability Test)	Logging Symptom and triggers	Logging medications (Automated reminders proposed)	Not measured (Usability only)	Yes (Customizable)	Alerts about doctor's appointment	Validated usability of theory-based app features; identified need for customization.
MacDonell et al.[22]	Text messaging (EMA)	Automatic text messaging for Symptoms	Time-based Reminders (Automated)	Not measured	Yes (Personalized feedback)	Not explicitly measured	Feasible for real-time data capture; low adherence rates identified.
Mulvaney et al.[27]	Mobile Phone / EMA / IVR	Correlated with EMA adherence (r=-0.33)	EMA monitoring of adherence	Measured via PAQLQ (Mean 5.5)	No (Assessment only)	No	Feasible method to assess symptoms; identified social barriers (peers).
Ramsey et al.[17]	Preferences (App/Text)	N/A (Preference study)	Desire for Reminders & Tracking	N/A	Yes (Desired feature)	Sharing data with provider	Identified preferences: customization, aesthetics, and provider connectivity.
Miles et al.[28]	Systematic Review	Barriers identified (e.g., poor control)	Facilitators: Reminders, Education	Facilitator: Normalization of life	Yes (Need for tailored support)	Partnership is key facilitator	Identified trust and communication as critical for self-management.
Teufel et	SAMS App + Bluetooth	Captured new symptom	30% adherence	Acceptability high	Yes (Contextu	Data viewable by	Feasible; adherence low but responsive

al.[23]	Inhaler	episodes (10)	(increased w/ symptoms)		al sensing)	provider	to symptoms/boredom.
Hollenbach et al.[29]	EMD + BreatheSmart App	Secondary Outcome (ACT)	Primary Outcome (EMD Adherence)	Secondary Outcome (PedsQL)	Yes (Medication reminders)	Provider Portal included	Protocol paper; establishes feasibility of EMD in diverse pediatric population.
Stukus et al.[30]	AsthmaCare App	Improvement reported (79% vs 64%)	Reminders included	Not primary outcome	Yes (Treatment plan)	No sig. effect on acute care	No reduction in ED visits/hospitalizations; reduced Urgent Care visits.
Johnson et al.[31]	MyMediHealth (Text/Web)	No significant change in ACT	Improved self-reported adherence (P=.011)	Improved (P=.037)	Yes (Schedule customization)	Not explicitly measured	Improved adherence, self-efficacy, and QoL; feasibility demonstrated.
Nichols et al.[14]	SAMS App	Feasibility of tracking	Video inhaler technique assessment	Qualitative themes: Impact on life	Yes (SDT-based)	Synchronous telehealth visits	Enhanced autonomy and competence; validated SDT in mHealth design.
Fedele et al. al.[13]	ReACT App	Targeted via self-regulation	Addressed barriers to ICS use	Not measured (Development)	Yes (Adaptive intervention)	Not explicitly measured	High favorability (93%) of content; iterative design crucial for engagement.

Table 2. Effect of mHealth Interventions on Asthma Outcomes.

Medication Adherence and Symptom Control

The most consistent finding across the studies was the positive impact of mHealth on medication adherence, particularly when interventions included automated reminders or tracking features.[31] demonstrated a statistically significant improvement in self-reported adherence (*P*=.011) among adolescents using the *MyMediHealth* system compared to controls. This suggests that simple, customizable reminders can effectively bridge the gap between intention and action in medication routines.

However, the relationship between adherence and symptom control was more complex. While adherence improved,[31] did not observe a corresponding significant improvement in Asthma Control Test (ACT) scores (P=0.728) within the short 3-week study duration. This disconnect highlights a potential lag time between behavioral change and physiological improvement, or perhaps the influence of external environmental factors that medication alone cannot immediately mitigate.

[23]Provided a fascinating insight into the contextual drivers of adherence. Using EMA, they found that adherence actually increased on days when adolescents reported feeling "bored" or experiencing symptoms. This counter-intuitive finding suggests that for some adolescents, asthma management is a task attended to when competing distractions are minimized or when physiological cues (symptoms) become undeniable. This underscores the need for interventions that can maintain adherence even when patients are asymptomatic or busy, breaking the cycle of reactive management.

Healthcare Utilization: The Efficacy Gap

A critical finding of this review is the discrepancy between behavioral improvements and hard clinical outcomes like Emergency Department (ED) visits.[30] in a large randomized controlled trial, found no significant decrease in ED visits or hospitalizations among children using the AsthmaCare app compared to controls, despite high engagement and self-reported improvements in management.

This "efficacy gap" suggests that while mHealth tools are feasible and can change behavior, they may not be sufficient in isolation to prevent severe exacerbations in high-risk African American populations. Factors such as housing quality (mold, pests), access to primary care, and environmental pollution, structural determinants of health may overwhelm the benefits of improved self-management behaviors in the short term. It implies that digital interventions must be integrated into broader, multi-component care strategies that address these root causes.

Psychosocial Outcomes and Quality of Life

Beyond clinical metrics, several studies highlighted the positive impact of mHealth on psychosocial well-being. Significant improvements were noted in both self-efficacy (*P*=.016) and quality of life (*P*=.037) for the intervention group.[31] By empowering adolescents to track their own health and providing them with reliable information, these tools foster a sense of agency and competence.

Qualitative data indicated that participants felt apps provided a greater sense of control over their condition and reduced feelings of isolation.[14,17] Social context plays a massive role in non-adherence, noting that adolescents were significantly less likely to use their inhalers when with friends.[27] This finding illuminates the social stigma associated with asthma in this age group and suggests that future interventions need to include social support components or discreet modes of use to mitigate embarrassment.

Discussion and Future Directions

Interpreting the Disparities in Engagement

While mHealth offers a route to circumvent traditional barriers to care, it introduces new challenges related to digital equity. Despite the overall success of their intervention, system usage was lower among African American participants compared to other groups.[31] This

variance in engagement is a critical finding. It warns against the assumption that access to technology equates to effective utilization.

Factors such as digital literacy, trust in the medical system, and the cultural relevance of the content likely play significant roles. The reviewed work demonstrated a path forward. For example, by utilizing a crowdsourcing approach (n=257) to refine intervention content, they achieved a 93% favorability rating.[13] This validates the necessity of user-centered design that actively involves the target demographic in the creation process, ensuring that the language, aesthetics, and features resonate with African American youth.

The Necessity of Theory-Driven Design

The review indicates maturation in the field, moving from simple digitization of paper diaries to complex, theory-driven interventions. The application of self-regulation theory[13,26] and self-determination theory[14] has proven effective in increasing user satisfaction. These theories respect the developmental need for autonomy in adolescence. Future interventions should explicitly map app features to theoretical constructs, for example, using visualization of adherence data to support self-monitoring (self-regulation) and providing choices in notification settings to support autonomy (self-determination).

Limitations of the Current Evidence Base

The insights drawn from this review must be interpreted in light of the limitations of the included studies.

- Sample Size and Duration: Many studies were pilot or feasibility trials with small sample sizes (e.g., n<20) and short durations (<3 months). This limits the statistical power to detect changes in rare events like hospitalizations.
- Self-Report Bias: Several studies relied on self-reported adherence, which is prone to recall bias and social desirability bias. The shift toward Bluetooth sensors addresses this but introduces technical challenges.[23,29]
- Lack of Long-Term Follow-Up: Few studies followed participants long enough to observe sustained behavioral change or the long-term impact on disease trajectory.

Recommendations for Future Research and Practice

1. Prioritize Longitudinal RCTs: The field must move beyond pilot studies to fully powered, longitudinal RCTs capable of measuring distal clinical outcomes like ED utilization and lung function over 12+ months.
2. Integrate Objective Monitoring: Future studies should standardly employ objective measures of adherence (e.g., electronic monitoring devices) to validate self-reported data, as demonstrated by the Hollenbach protocol.
3. Address Social Determinants: mHealth interventions should be designed not just as isolated tools but as components of comprehensive care models that link patients to social services (e.g., connecting families with housing resources to address environmental triggers).
4. Focus on Emerging Adults: Specific attention is needed for the 18-29 age group[22], a cohort often lost to follow-up during the transition to adult care. Interventions for this group should emphasize independence and navigation of the adult healthcare system.

Conclusion

The integration of mHealth technologies into asthma management for African American adolescents and emerging adults represents a promising frontier in health equity. This scoping review identified 13 studies that collectively demonstrate the feasibility and acceptability of these interventions. Key successes include improved medication adherence, enhanced self-efficacy, and the validation of user-centered designs.[14,31]

However, a significant gap remains between behavioral improvements and tangible clinical outcomes. The lack of significant reduction in acute care utilization in major trials suggests that

digital tools, while beneficial, are not a panacea.[30] They must be part of a broader, multi-component strategy that addresses the environmental triggers and structural inequities driving asthma morbidity in African American communities.

To realize the full potential of mHealth, future initiatives must embrace culturally tailored content, leverage behavioral theory, and ensure equitable access to both the technology and the healthcare systems it connects to. Only through such a holistic approach can we hope to close the asthma disparity gap for the next generation of African American youth.

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Nelson McNova Bryant is solely responsible for the conception or design of the work, data acquisition, analysis, and interpretation, as well as the drafting, revising, and final approval of the completed version of the paper.

Data Availability
The data supporting the findings of this study are available from the corresponding author upon request.

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