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REVIEW

A Review of the Use of Mobile Health Interventions in Patients with Inflammatory Bowel Disease

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Abstract: The management of inflammatory bowel disease (IBD), encompassing Crohn's disease and ulcerative colitis, presents significant challenges due to its chronic, relapsing nature. Mobile health (mHealth) technologies, leveraging smartphones and wearable devices, offer innovative approaches to support long-term care. This narrative review synthesizes current evidence on the use of mHealth interventions in IBD management. This narrative review draws on representative literature identified through a search of PubMed, Embase, and Web of Science (2010–2023). It explores various forms, including health applications, wearable devices, and telemedicine, and their roles in symptom monitoring, medication adherence, dietary management, and psychological support. Synthesized findings from clinical studies indicate that these tools can contribute to improved disease control, adherence rates, and quality of life. The review also discusses key challenges such as data privacy, implementation barriers, and digital literacy, while highlighting future directions involving artificial intelligence for personalized care and interdisciplinary collaboration. Overall, mHealth presents a promising avenue to enhance patient-centered IBD management, though its integration into routine care requires addressing technological, regulatory, and user-centric considerations.

Keywords: mobile health interventions, inflammatory bowel disease, health apps, wearables, telemedicine

Inflammatory bowel disease (IBD), encompassing ulcerative colitis (UC) and Crohn's disease (CD), is a chronic, non-specific inflammatory condition of the gastrointestinal tract with an unclear etiology. Its pathogenesis is understood to involve a complex interplay of genetic predisposition, immune dysregulation, environmental triggers, and alterations in the gut microbiota, contributing to a relapsing-remitting disease course that poses significant long-term management challenges.[1,2] Historically considered a disease of Western populations, IBD exhibits a higher prevalence in regions such as North America, Europe, and Australia, with incidence rates reported to be 10–20 times higher than in many Asian countries.[3] However, due to changes in lifestyle and environmental factors, its incidence is rising rapidly in newly industrialized areas, including Asia.[4] In China, IBD incidence is the highest in Asia, approximately 3.44 per 100,000, representing a significant and growing public health challenge.[5] Furthermore, other Asian nations such as Japan, South Korea, and India are also reporting accelerating rates, albeit with notable variations in clinical presentation, disease behavior, and access to specialized care across the region.[6,7] Patients commonly experience symptoms such as abdominal pain and diarrhea, with a prolonged and relapsing disease course requiring long-term medication, regular outpatient follow-ups, and, in some cases, repeated hospitalizations.[8] The unpredictable nature of disease flares contributes to considerable psychological distress, including anxiety and depression, which further complicates management.[2] These conditions significantly impair patients' physical and mental quality of life and impose substantial economic burdens on society, including direct medical costs and indirect productivity losses.[9,10] Within Asia, the rapid epidemiological transition, coupled with diverse healthcare infrastructures and cultural attitudes towards chronic disease management, underscores the need for scalable and adaptable care models.[2] To address the growing and diverse healthcare needs of

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patients with IBD, healthcare services are increasingly extending to home and community settings.[11] Consequently, there is an urgent need to develop effective methods for long-term monitoring, management, and patient education. While prior systematic reviews have summarized digital health technologies in IBD,[12] this narrative review aimed to provide a comprehensive synthesis of diverse mHealth modalities. We identified representative literature through a narrative search of major databases (eg, PubMed, Embase, Web of Science) from 2010 to 2023, focusing on key concepts such as mobile health, IBD, telemedicine, health apps, and wearables. This review also critically examines implementation challenges and regional disparities, particularly in Asian contexts where evidence remains scarce.

It is also important to acknowledge that the adoption of mHealth is not without limitations. Challenges such as data privacy concerns, digital literacy gaps among patients and providers, interoperability issues with existing health systems, and the risk of technological alienation for certain demographics must be considered alongside its potential benefits[13] This narrative review aims to (1) synthesize current evidence on the forms and applications of mHealth interventions in IBD management; (2) evaluate their efficacy across key domains including symptom monitoring, medication adherence, dietary management, and psychological support; (3) discuss implementation challenges and regional perspectives, with a focus on gaps in Asian research; and (4) propose future directions for integrating mHealth into holistic, equitable, and sustainable IBD care.

Definition and Form of mHealth Intervention

Definition of mHealth Intervention

According to the World Health Organization(WHO), mobile health (mHealth) is defined as "medical and public health practice supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants (PDAs), and other wireless devices".[14] It constitutes a subset of electronic health (eHealth) and focuses specifically on the use of mobile and wireless technologies to deliver health services and information. Building on this, researchers have further conceptualized mHealth as a broad range of digital tools and platforms that leverage mobile technology to provide intelligent, personalized, and convenient support for health management, with the overarching aim of enhancing the quality, accessibility, and efficiency of healthcare delivery and patient self-management, rather than being limited to improving specific aspects such as nursing services.[11] mHealth encompasses a diverse and often overlapping range of digital tools and platforms. For clarity in this review, we categorize them into five primary, yet interconnected, modalities: (1) health applications (apps); (2) wearable devices; (3) telemedicine services; (4) online health communities and social networks; and (5) data analytics and artificial intelligence (AI). These modalities collectively aim to enhance healthcare delivery and patient self-management. For chronic conditions like IBD, characterized by recurrent flares, psychological stress, and dietary restrictions, mHealth interventions are tailored to support continuous monitoring, patient education, and self-management, addressing the complex needs of these patients.[13] The goal of mHealth is to enhance the efficiency and accessibility of health management through technological means, thereby improving patient outcomes.

Main Forms of mHealth Intervention

The following subsections describe the primary forms of mHealth interventions relevant to IBD management. It is important to note that these categories are not mutually exclusive; many practical mHealth solutions integrate features from multiple forms (eg, an app that includes symptom tracking, connects to a wearable device, and facilitates teleconsultations).

Health Applications

Health applications (apps) are software programs designed for smartphones or tablets to support healthcare delivery and patient self-management. As a specific technological tool, they are a core component and a common delivery vehicle for broader mHealth interventions.[14] In recent years, MHA has developed rapidly, significantly enhancing patient care and treatment experiences, as well as transforming healthcare service models. Several reviews have summarized the features and efficacy of available apps for IBD patients, highlighting their role in symptom tracking, education, and self-management support.[12] An increasing number of researchers are using MHA as a crucial tool for patient support and continuity of care, applying it in construction, product development, evaluation, and clinical application. Its advantages

in telemedicine and continuous health management are particularly evident, providing patients with more convenient, accessible, and personalized health support and treatment services. Users of health apps can record personal health data, access health information, and manage healthy behaviors through these applications. Common functionalities include: symptom tracking, which helps users record and analyze symptoms to better manage their illnesses; diet and exercise support, offering dietary advice and exercise plans to promote a healthy lifestyle; and medication management, reminding users to take their medications on time and providing medication information.[15,16] These functionalities enable patients to engage in self-care, improving disease management and decision-making, as discussed later in the context of IBD.[17]

Wearable Devices

Healthcare wearable devices (HWDs) are devices embedded with sensor technology, information technology, and human-computer interaction capabilities that can be worn on the body.[16–18] This device can capture information related to health conditions using sensors, identify abnormal situations, and track and process them to assist in improving the management of chronic diseases. HWDs mainly fall into three categories:[19] First, skin-based HWDs, which are categorized based on whether they come into direct contact with the skin, including electronic skin-based wearable devices, soft wearable devices, and textile-based wearable devices. By body part, they include head, arm, trunk, and foot HWDs. Second, biofluidic-based HWDs, which integrate cutting-edge technologies such as flexible epidermal electronics, microfluidic chip technology, and electrochemical techniques to continuously collect and detect biomarkers in blood, urine, sweat, tears, and saliva in a real-time, dynamic, and non-invasive manner.[19] Third, wearable drug delivery systems (DDS). With the development of biodegradable and biocompatible materials, wearable DDS can be applied. It mainly uses the combination of drugs and sensors to achieve targeted drug delivery and improve medication compliance.

In recent years, wearable devices have developed rapidly in various fields including rehabilitation (eg, post-stroke), chronic disease monitoring (eg, epilepsy, cardiopulmonary conditions), and oncology (eg, monitoring of lung cancer patients).[20–26] Policies in various countries are advancing the supervision and management of digital health technologies, which has led to the rapid development of mHealth devices, medical device applications, and wearable technology for research on medical products. HWDs (such as smartwatches and fitness trackers) provide users with health feedback by monitoring physiological indicators in real time, such as heart rate, step count, and sleep quality. These devices not only facilitate daily health management but also play a significant role in chronic disease monitoring. For example, diabetes patients can monitor their blood glucose levels through wearable devices, thereby better managing their condition. Studies have shown that patients with IBD have a high acceptance of HWDs, finding them to be an important source of information related to their condition and preferring wrist-worn devices.[27] With the development of biosensor technology, HWDs have gradually shown greater value in IBD diagnosis, treatment and prognosis in addition to monitoring vital signs parameters.[20]

Telemedicine

Telemedicine utilizes video conferencing and instant messaging technologies to enable patients to receive medical consultations and treatments from home.[28] It is defined as an innovative healthcare service that broadens access to medical care and information through electronic information and communication technologies. It integrates remote monitoring, remote treatment, remote education, and remote diagnosis, aiming to enhance medical standards and promote patient self-management of their conditions[29] This form is especially suitable for patients with chronic diseases and patients in remote areas. A study by de Jong et al[30] using the MyIBDcoach telemedicine platform demonstrated that telemedicine improved patient satisfaction by 25% (based on patient-reported surveys) and reduced outpatient visits by 15%, enhancing medical efficiency for IBD management.[31] Relying on the rapid development of Internet and mobile communication technology, telemedicine has entered a new stage. At present, telemedicine is well-established in many countries, with widespread adoption in the management of diabetes, heart disease, and IBD.[32–34] In the process of treatment and care, a systematic application system has been formed. In some regions, such as China, telemedicine adoption initially lagged but has accelerated recently, helping to address geographical disparities in healthcare access.

Telemedicine in IBD includes remote monitoring, tele-education, and tele-treatment. Remote monitoring collects physiological indicators, symptoms, medication adherence, and nutritional status, transmitting data to monitoring centers for analysis and recommendations.[35] Tele-education platforms, such as IBDLIVE, facilitate interdisciplinary case discussions and patient self-management guidance.[36] Tele-treatment enables real-time consultations and remote medication management, enhancing diagnostic capabilities and reducing readmission rates.[37,38]

Health Communities and Social Networks

Some mHealth platforms facilitate communication and peer support among patients, forming online health communities. These communities offer spaces for patients to share experiences and emotional support, which helps alleviate psychological stress and enhance self-management abilities. Furthermore, integrating mHealth into community health services can enhance operational efficiency, support patient-centered care models, facilitate continuous disease management, and promote coordinated service delivery. The advantages and challenges arising from the deep integration of mobile internet technology with health services have become a research focus in recent years. Therefore, as mobile healthcare is widely studied in health management, integrating mobile healthcare into community health management aligns with the basic requirements of community health management, making it imperative. Establishing a community health management model based on mobile healthcare not only holds significant importance for improving residents health quality and transitioning from treating diseases to preventing them, but also plays a crucial role in reducing medical costs, easing doctor-patient relationships, and reasonably adjusting and optimizing healthcare resources.[39]

Data Analytics and Artificial Intelligence in mHealth

Data analytics and artificial intelligence (AI) represent advanced capabilities increasingly integrated into mHealth platforms. By systematically analyzing large volumes of user-generated health data (eg, from apps and wearables), these technologies can uncover patterns, generate predictive insights, and enable personalized health recommendations, thereby moving beyond simple data collection to intelligent intervention. This intelligent intervention approach enhances the relevance and effectiveness of interventions. In recent years, advancements in deep learning algorithms[40] and technological progress have led to the rapid development of artificial intelligence (AI)-based medical devices, showing a wide range of application prospects. For example, significant breakthroughs have been made in research fields such as auxiliary detection, auxiliary diagnosis, and clinical decision support, and several AI-based medical products have received regulatory approval for clinical use.[41] With the development of artificial intelligence chips and the improvement of hardware configurations in mobile terminal products, the deployment and application of AI algorithms on mHealth terminals have become a reality. This has expanded the application areas of AI medical devices to outside hospitals and homes, extending the processing targets to personal health data under non-medical conditions, allowing more ordinary people to experience the convenience brought by technology. For patients with IBD, AI-driven mHealth tools can analyze symptom logs, dietary records, and physiological data from wearable devices to predict disease flares and recommend personalized treatment adjustments. For instance, AI and machine learning models have been developed to analyze patient data for predicting disease flares. A review by Cohen-Mekelburg et al[42] highlighted the clinical applications of such AI-based methods in IBD, demonstrating their potential for enabling timely interventions and improving outcomes.

Current Status of mHealth Intervention in IBD Patients

Building on the diverse forms of mHealth interventions described earlier, such as health apps, wearable devices, telemedicine, community networks, and AI-driven analytics, these technologies have been increasingly tailored to address the unique challenges faced by patients with IBD. The chronic and relapsing nature of IBD, characterized by symptoms like abdominal pain and diarrhea, necessitates ongoing management strategies that mHealth tools are well-suited to provide. Moreover, patients with IBD face specific challenges, including frequent disease flares that require proactive monitoring, psychological burdens such as anxiety and depression due to unpredictable symptoms, and strict dietary restrictions to avoid symptom triggers.[2] mHealth interventions are designed to address these needs by offering real-time symptom tracking, mental health support, and personalized dietary guidance, enabling patients to manage their condition more effectively.[43–45] This section examines the practical applications of these interventions in IBD, focusing

on their role in symptom monitoring, drug compliance, dietary management, and mental health support, supported by specific examples and outcomes from recent studies.

Symptom Monitoring and Recording

mHealth apps allow patients to record key indicators such as symptoms, bowel movement frequency, and the severity of abdominal pain in real time. This functionality supports proactive disease management by enabling patients to track their condition and share data with healthcare providers. In the context of mHealth, symptom monitoring methodologies are often categorized into two types: active and passive monitoring. This categorization is commonly used in digital health research to distinguish between patient-initiated data entry and device-automated data collection.[46,47] An example of active monitoring in IBD is the HealthPROMISE app, evaluated in a study by Atreja et al[48] and further reported by Zhen et al.[49] This app allowed patients to log symptoms such as abdominal pain and bowel movement frequency in real time. The study reported a 30% improvement in patient-reported disease control and a 15% reduction in unplanned healthcare visits among 150 patients with IBD over 6 months, underscoring the app's role in facilitating timely interventions. Passive monitoring via wearable devices, such as Fitbit, was explored in a pilot study by Hirten et al,[50] where 50 patients with IBD used wrist-worn devices to track heart rate variability and sleep patterns. The study found that 70% of participants showed improved symptom prediction accuracy, correlating physiological data with flare-ups, thus supporting proactive clinical interventions. These findings highlight how mHealth tools have the potential to enhance IBD management by providing precise, data-driven insights.

Drug Compliance Management

Many mobile applications provide drug management functions to help patients take their medication on time, remind them to take their medicine and record the use of drugs. Studies have shown that such applications can significantly improve the drug compliance of patients with IBD and reduce the recurrence rate.[51] For instance, a randomized controlled trial by Cross et al[35] evaluated the MyIBD app among 200 patients with IBD. The app provided medication reminders and educational content, resulting in a 25% increase in adherence rates (from 60% to 85%) and a 12% reduction in disease flares over 12 months compared to a control group receiving standard care. The app provided medication reminders and educational content, resulting in a 25% increase in adherence rates (from 60% to 85%) and a 12% reduction in disease flares over 12 months compared to a control group receiving standard care. With the help of cloud platform to provide feedback health education for home patients with IBD, it was found that the feedback health education mode based on cloud platform could improve the self-management ability, knowledge level, medication compliance and body mass index of patients with IBD after 3 months of intervention.[52]

Dietary Assessment and Management

Diet has a significant impact on patients with IBD. Many apps allow users to record their eating habits and analyze the relationship between specific foods and symptoms. This dietary tracking can help patients identify triggers and adjust their eating habits to improve symptoms. Dorit Vedel Ankersen et al[53] The value of web applications for monitoring and treating IBS symptoms in patients with IBD has been demonstrated. Disease monitoring through web applications can improve patient compliance and improve the natural course of IBD; Samuel N Jactel et al[54] It has been demonstrated that digital technology can be used to implement personalized dietary intervention and improve compliance in patients with IBD; Konrad Stawiski et al[55] It points out that interactive applications can be used as digital diet diaries, as well as as analytical and predictive tools for patients and doctors. A notable example is the IBD-AID diet app, evaluated in a study by Olendzki et al,[56] which guided 100 patients with IBD in tracking food intake and symptom correlations. The study reported that 65% of participants experienced reduced symptom severity after 8 weeks, with a 20% improvement in quality of life scores, underscoring the app's role in personalized dietary management.

Mental Health Support

Mental health problems, such as anxiety and depression, are common among patients with IBD, often exacerbated by the unpredictable nature of disease flares and the social limitations imposed by symptoms like diarrhea. Psychological support services, such as online counseling and cognitive behavioral therapy, provided by mHealth platforms have been shown to have a positive impact on the mental health of patients. These interventions are particularly valuable for patients with IBD, as they offer accessible, on-demand support to manage stress and emotional challenges, reducing the psychological burden of living with a chronic condition. For example, a study by Rafael González-Moret et al[57] evaluated a mobile app delivering cognitive behavioral therapy to 94 patients with IBD over 10 weeks, reporting a 35% reduction in anxiety scores (HADS) and a 20% improvement in quality of life (IBDQ), demonstrating the app's efficacy in addressing IBD-related psychological distress.

Zhou et al[58] designed a patient self-management software based on the characteristics of IBD. This software operates on a cloud platform and includes standardized monitoring records for psychological stress, disease activity index, and other conditions. It also creates an ecosystem for information sharing among patients, doctors, caregivers, and others, providing a foundation for big data on IBD patient health. Zhao Shumin et al.[59] Studies have confirmed that out-of-hospital continuing care through wechat platform can improve the adverse psychological state and quality of life of patients with IBD. Zhao et al[60] demonstrated that a psychological intervention plan for IBD patients based on a physician-patient management platform improved patients' psychological status and further promoted the development of good self-management behaviors. This provides a reference for the IBD medical team to formulate more scientific and practical psychological intervention strategies.

The application of mHealth intervention in patients with IBD is gradually maturing, providing comprehensive health management support through symptom monitoring, medication management, dietary tracking, psychological support, and other forms. With continuous technological advancements, the potential of mHealth intervention in IBD management will further expand in the future.

To contextualize the current adoption landscape, it should be noted that while large-scale epidemiological data on the penetration of mHealth in routine IBD care are still emerging, surveys and observational studies indicate growing acceptance and use. For instance, a cross-sectional survey by Hirten et al (2021) reported that over 70% of IBD patients expressed willingness to use wearable devices for disease management.[27] However, widespread implementation in clinical practice varies by region and healthcare system, often influenced by factors such as reimbursement policies, digital literacy, and integration with electronic health records. Future efforts should focus on standardizing implementation pathways and generating real-world evidence to bridge the gap between technological potential and routine clinical adoption.

Assessment of mHealth Interventions: Outcomes and Measurement Tools

When evaluating the use of mHealth in patients with IBD, different assessment tools can be selected according to the evaluation content. If the clinical symptoms are improved, C D patients can use the Harvey-Bradshaw Index (HBI) for the assessment of disease activity in Crohns disease[61] HBI is a relatively simple, practical and can more truly reflect whether the patients disease activity is active or not, as well as the severity of the standard, which is also the main standard currently used in clinical practice. U C patients can choose the Mayo scoring (Ulcerative Colitis Mayo Score, UCMS)[62] UCMS is a tool used to assess the severity and treatment effectiveness of ulcerative colitis. The scoring system includes four aspects: bowel movements, blood in stool, colonic mucosal inflammation, and overall physician evaluation. Each aspect has corresponding scores, with higher totals indicating more severe conditions. The total score is the sum of these four aspects, with a maximum of 12 points. Based on the total score, the condition can be divided into several stages: Clinical Remission: 0–2 points; Mild Activity: 3–5 points; Moderate Activity: 6–10 points; Severe Activity: 11–12 points. By regularly measuring these scores, changes in patient symptoms can be quantified. For example, a study by de Jong et al[63] used the HBI and UCMS to evaluate the impact of the MyIBD coach telemedicine platform on 300 patients with IBD. The results showed a significant reduction in HBI scores (from 8.2 to 5.6) and UCMS scores (from 7.1 to 4.8) after 6 months, indicating improved disease control. Additionally, patient self-reported symptom diaries can be used to track daily symptom changes, including the frequency and intensity of abdominal pain and the number of diarrhea episodes. To evaluate quality of life, the Inflammatory Bowel Disease Quality of Life Questionnaire (IBDQ) is

frequently employed. Among the various disease-specific health-related quality of life instruments validated for IBD, the IBDQ is a commonly recommended and frequently used instrument, demonstrating strong reliability and responsiveness to clinical change.[64] Developed by Guyatt et al, it consists of 32 questions, divided into four dimensions: gut symptoms (10 items), systemic symptoms (5 items), emotional function (12 items), and social function (5 items). Each question is scored from 1 (worst case) to 7 (best case), so the total score ranges from 32 to 224 points. This scale evaluates multiple dimensions of health status to help assess patients quality of life. Higher scores indicate better quality of life, social, and physical functions. A clinical trial by Casper Steenholdt et al involving 250 IBD patients using a mobile app for self-management reported a 22% increase in IBDQ scores (from 145 to 177) after 12 weeks, reflecting enhanced quality of life. This study exemplifies the use of IBDQ in mHealth research. The IBDQ's validated properties and sensitivity to change, as demonstrated in this and other trials, further support its role as a key outcome measure in IBD care. To assess patient compliance and engagement, backend analytics can track app usage metrics, such as daily login frequency and duration of use. A study by Nazanin Jannati et al[65] tracked app engagement in 180 patients with IBD and found that patients with high engagement (logging in >5 times/week) had a 30% higher adherence to treatment plans compared to low-engagement users. Engagement in interventions can be assessed by recording the number of patients participating in online health education courses or virtual support groups and their participation frequency. For assessing mental health in patients with IBD, the Hospital Anxiety and Depression Scale (HADS) is a commonly applied instrument. It was selected due to its brevity, validation in somatic conditions including chronic gastrointestinal diseases, and its focus on symptoms less confounded by physical illness compared to other depression scale.[66,67] Developed in 1983 by Zigmond and Snaith, it is a self-rating scale comprising two 7-item subscales for anxiety and depression, respectively. The HADS scores help quantify the levels of anxiety and depression, thereby aiding in the evaluation of an intervention's impact on the psychological well-being of patients. Assessing changes in healthy behaviors can be observed through patients dietary notes, encouraging them to record their daily diet in an app and analyze its effect on symptoms. For example, recording the intake of high-fiber foods or dairy products. Through these specific evaluation indicators, the effectiveness of mHealth interventions in IBD patients can be comprehensively assessed, providing a basis for subsequent clinical practice and research. Figure 1 illustrates the application strength of mHealth interventions in IBD management, encompassing health applications, wearable devices, telemedicine, health communities, and data analysis with artificial

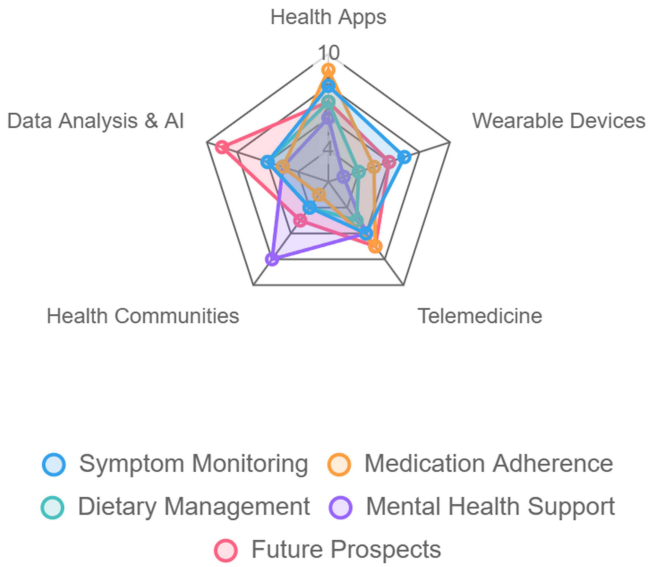

Figure 1 Application of mHealth Interventions in IBD Management. This figure conceptually illustrates the relative application strength of five key mHealth intervention modalities in IBD management across core domains. The depicted strengths are synthesized from the evidence reviewed in this article, including randomized controlled trials, cohort studies, and patient surveys cited herein (e.g.,)[29,42,44,46,50,68] They represent a qualitative summary based on the reported efficacy, frequency of use, and potential impact described in the current literature, rather than a quantitative meta-analysis. The figure was created using graphic design software (eg, Microsoft PowerPoint) to visually synthesize findings and does not involve statistical analysis tools. The figure aims to provide a visual overview of the landscape and highlight areas where different technologies show particular promise or established utility.

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intelligence across symptom monitoring, medication adherence, dietary management, mental health support, and future prospects, comprehensively reflecting the multidimensional contributions of mHealth interventions.

Future Perspectives

Figure 1 summarizes the relative application strengths of different mHealth modalities across the core domains of IBD management discussed in this review. As illustrated, health applications currently demonstrate strong utility in symptom monitoring and medication adherence, while data analytics and artificial intelligence show growing potential for predictive insights. Wearable devices and telemedicine also play significant and complementary roles. This visual synthesis underscores the multifaceted nature of mHealth in IBD and provides a foundation for considering its future evolution.

In patients with IBD, the application prospects of mHealth are very broad. First, personalized medical approaches can be adopted by leveraging intelligent algorithms and big data analysis, combined with machine learning and artificial intelligence technologies to conduct in-depth analyses of patients medical records, symptom logs, and lifestyle habits, thereby providing personalized treatment recommendations and interventions. For example, AI-driven apps could integrate data from electronic health records, wearable devices, and patient-reported outcomes to generate tailored dietary or medication plans. A practical implementation path could involve developing cloud-based platforms that use recurrent neural networks to predict flare-ups based on longitudinal symptom data, as explored in studies on AI applications in IBD.[42,69] However, technical challenges include ensuring algorithm robustness across diverse patient populations and managing the computational costs associated with real-time processing. However, technical challenges include ensuring algorithm robustness across diverse patient populations and managing high computational costs for real-time processing. Second, enhancing patient engagement by developing more interactive mobile applications that encourage patients to record their symptoms and health data for self-management. This could involve integrating gamification elements, such as progress trackers or virtual rewards, into apps like MyIBDcoach,[29,63] which have been shown to increase patient engagement in studies. A key challenge lies in designing user-friendly interfaces that accommodate varying levels of digital literacy, particularly among older patients. Alternatively, establishing community support platforms to facilitate communication and support among patients through mobile applications, sharing experiences, coping strategies, and encouragement. Third, remote monitoring and management, which may involve using wearable devices to monitor physiological indicators (such as heart rate, activity levels, stress levels) and correlate them with IBD symptoms. For instance, wrist-worn devices like Fitbit could be paired with apps to track heart rate variability and sleep patterns, with data fed into predictive models for flare detection.[70] Fourth, behavioral intervention and habit change through evidence-based engagement strategies. Beyond gamification elements such as points and badges, effective approaches may include goal-setting frameworks, personalized feedback loops, social support integration, and principles from behavioral economics (eg, commitment devices).[71] Fifth, establish a comprehensive medical team to facilitate collaboration among nutritionists, psychologists, and gastroenterologists. Share patient information via mHealth platforms to provide integrated medical services, followed by cross-platform data integration. This could be achieved through standardized application programming interfaces (APIs) to enable seamless data sharing across platforms like Epic[72] or Cerner.[73] However, challenges include ensuring compliance with data privacy regulations (eg, HIPAA)[74] and resolving data format inconsistencies. Through randomized controlled trials, such as those comparing app-based interventions to standard care, researchers can quantify outcomes like adherence rates or flare reductions. A technical hurdle is recruiting diverse cohorts to ensure generalizability, as small sample sizes may limit statistical power. Subsequently, continuously improve and feedback mechanisms based on patient and healthcare provider feedback to continually optimize the functionality and user experience of mHealth applications.

Beyond data privacy and clinical validation, several broader challenges merit consideration for the successful integration of mHealth into routine IBD care. A key barrier is the variable level of eHealth literacy among patients, which influences their ability to effectively access, understand, and apply digital health information. Implementing mHealth solutions also faces logistical hurdles, including interoperability with existing electronic health record systems, sustainable funding or reimbursement models, and workflow integration for healthcare providers. Furthermore, the patient experience of constant self-monitoring and digital reminders requires careful design to avoid alert fatigue,

therapeutic burden, or increased anxiety. Addressing these challenges—through tailored patient education, user-centered design, and systematic implementation science approaches—is crucial to ensure that mHealth technologies are not only efficacious but also equitable, adoptable, and sustainable in real-world settings.

Limitations and Regional Perspectives

Despite the promising evidence summarized in this review, several important limitations must be acknowledged to contextualize the findings and guide future work. First, the variability in digital literacy and access to technology among patients can create inequities in who benefits from mHealth interventions. Second, there is a lack of standardized implementation protocols and integration pathways with existing electronic health record systems, which hinders scalability and routine clinical adoption. Third, data privacy and security remain paramount concerns, potentially affecting patient trust and engagement. Fourth, much of the current evidence comes from short-term studies or controlled trials; robust, long-term efficacy and cost-effectiveness data from real-world settings are still limited.

Furthermore, a significant geographical bias exists in the current evidence base. The majority of high-quality studies on mHealth in IBD originate from Western Europe and North America. Evidence from Asian populations is relatively scarce, despite the region experiencing a rapidly rising incidence of IBD. Cultural attitudes towards health data sharing, varying levels of healthcare infrastructure and reimbursement policies, socioeconomic factors, and differences in patient-provider dynamics may all significantly influence the acceptability, effectiveness, and optimal design of mHealth tools in Asian contexts. Future research must prioritize culturally adapted studies and implementation science in diverse regions, including Asia, to ensure that the benefits of mHealth are equitable and generalizable across different healthcare landscapes.

Implications and Recommendations

The application of mHealth in patients with IBD offers new ideas and tools for patient management and treatment. In future research, first, emphasis should be placed on patient education, as patients understanding of their condition directly impacts treatment adherence and quality of life. Therefore, easily understandable educational materials and videos can be developed to introduce basic knowledge about IBD, symptom management, and lifestyle adjustments. For example, apps could embed short, interactive modules on dietary triggers or stress management, delivered via push notifications to enhance retention.[75] Second, enhance patients self-management skills, which are closely related to disease control. When designing mobile applications, powerful features that assist patients in recording symptoms, medication use, and dietary habits should be prioritized. For instance, integrating AI-driven chatbots to guide patients in setting personalized goals, such as reducing high-fiber food intake, could improve adherence, as seen in a 20% adherence increase in a 100-patient trial by Olendzki et al.[56] A technical difficulty is maintaining chatbot accuracy to avoid misleading recommendations. Third, strengthen data security and privacy protection. Patients concerns about data privacy may affect application usage rates; ensuring that mHealth apps comply with data privacy regulations, clearly informing users of data usage policies, and providing data encryption and security features is essential. This could involve implementing end-to-end encryption and blockchain-based data storage to secure patient data, but challenges include high implementation costs and ensuring compatibility with existing health systems.[76] Finally, encourage interdisciplinary collaboration. IBD management involves cooperation across multiple professional fields, so forming interdisciplinary teams, including nutritionists, psychologists, and gastroenterologists, is crucial. Mobile apps could integrate teleconsultation features to enable real-time collaboration, as piloted in the eHealth platform,[77] which reduced consultation times by 15% across 50 cases. A challenge is training providers to use integrated platforms efficiently. In mobile applications, health guidance content from various specialties is integrated to achieve information sharing. A feedback and iteration mechanism is implemented; user feedback is crucial for optimizing the application. For example, deploying in-app surveys with natural language processing to analyze open-ended feedback could identify usability issues, but processing large volumes of unstructured data poses computational challenges. Regularly collecting user feedback helps understand their experiences and issues when using the app. Through surveys or online evaluation tools, user suggestions are gathered and continuously used to improve application functions. These insights and recommendations aim to better address the needs of patients with IBD through mHealth, enhancing treatment outcomes and improving quality of life.

Conclusion

This narrative review synthesizes the current evidence and future directions of mobile health (mHealth) interventions in the management of inflammatory bowel disease (IBD). Key findings indicate that mHealth tools, including health applications, wearable devices, and telemedicine platforms, enhance symptom monitoring, medication adherence, dietary management, and mental health support, leading to improved disease control and quality of life. However, several limitations must be acknowledged. First, the majority of studies originate from Western countries, with limited data from Asian regions such as China, where IBD incidence is rising but mHealth adoption remains in early stages. Second, issues related to data privacy, regulatory compliance, and digital literacy pose significant challenges to widespread implemen**tation**. Third, the heterogeneity of available mHealth tools and the variability in study designs limit the generalizability of findings. Future efforts should focus on developing culturally adapted mHealth solutions, strengthening interdisciplinary collaboration, and establishing standardized evaluation frameworks to optimize IBD care globally.

Abbreviations

mHealth, mobile health; MHA, mobile health applications; HWDs, healthcare wearable devices; AI, artificial intelligence; IBD, inflammatory bowel disease; UC, ulcerative colitis; CD, Crohn's disease.

Data Sharing Statement

The experimental data used to support the findings of this study are available from the corresponding author upon request.

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Disclosure

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