



Impact of Mobile Health Interventions on Diabetes Self-Management in Low-Income Countries

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ABSTRACT

Diabetes mellitus is a growing public health concern in low-income and low-resource countries. Mobile health interventions, as a tool to facilitate chronic disease self-management, offer a potential solution to the barriers for diabetes self-management such as lack of healthcare workers, poor access to care, long distances to healthcare facilities, and out-of-pocket expenses for monitoring and follow-ups. This article aimed to review the published literature on the effects of mobile health (mHealth) interventions on diabetes self-management in low-income countries. A systematic search of PubMed, ScienceDirect, Springer Nature, and PLOS journal articles was conducted using keywords to identify the impact of mHealth on diabetes self-management. Ten studies, published within the last decade, were included in the review following title and abstract screening and full-text assessment against predefined eligibility criteria. The included studies were published as trials, interventions or a systematic review of the impact of mHealth on diabetes self-management in low-income countries. Across the reviewed studies, mHealth interventions demonstrated inconsistent but generally positive effects on diabetes self-management outcomes. While some studies failed to show clinically significant improvements in glycaemic control, positive trends were reported for medication adherence, knowledge, and dietary/lifestyle changes. Across SMS text messaging, interactive voice response, and application trials, high levels of acceptability and feasibility were reported despite short follow-up durations. mHealth interventions were feasible, acceptable, and moderately effective in supporting diabetes self-management with inconsistent effects on glycemic control in low-income countries. There is a need for larger-scale studies with prolonged follow-up periods to explore the long-term effectiveness of selected interventions.

Keywords: Mobile Health; Diabetes Self-Management; Low-Income Countries; Mhealth; Glycaemic Control

INTRODUCTION

Background

Diabetes mellitus is one of the most prevalent and complex chronic diseases with a rapid increase in prevalence and mortality worldwide. The majority of adult diabetes patients are now based in low- and middle-income countries (LMICs) [1-2]. According to the International Diabetes Federation, the burden of diabetes in sub-Saharan Africa and South Asia continues to rise sharply, driven by urbanisation, dietary transitions, and limited preventive infrastructure (IDE, 2021). Diabetes management requires

self-care and adherence to medication, diet, and regular physical activity [3-7]. However, for patients in low-income countries, diabetes self-management can be challenging and stressful due to a limited healthcare workforce, poor primary care infrastructure, long distances to healthcare facilities, and the high cost of regular glucose monitoring and follow-up visits [2,8].

With increased mobile phone ownership and penetration in low-income countries, mHealth interventions, such as SMS text messaging, interactive voice response, and application use, are increasingly promoted as tools for improving chronic disease self-management through

reminders, education, and self-monitoring support [3-4,7,9]. Multiple trials across sub-Saharan Africa, South Asia, and North Africa have investigated the effectiveness of such mHealth interventions to improve diabetes knowledge, self-care, and glycaemic control, specifically in low-income settings. The World Health Organization has also recognised digital health solutions as a priority for strengthening health systems in resource-constrained environments (WHO, 2019). Despite this promise, the translation of behavioural improvements into sustained clinical gains remains uncertain, particularly where health system integration and long-term follow-up are limited [10-11].

Scholarly Contribution

This review aimed to contribute to the scholarly discourse in several ways. First, unlike previous reviews that mostly focus on mHealth interventions' impact on diabetes management in high-income settings, this review synthesises the impact of mHealth interventions on diabetes self-management in low-income countries as a separate entity [2,9]. Second, while most previous reviews focus on specific aspects of diabetes management interventions this review compares the effectiveness of different mHealth interventions, including SMS text messaging interactive voice response (IVR) peers or community health workers supported management and application on diabetes self-management [3-8,12]. Additionally, while most of the previous review articles focus on either clinical or behavioural outcomes, this review attempts to compare effectiveness in different domains (clinical, behavioural, and implementation). Finally, this review highlights the methodological limitations and inconsistencies of the reviewed region-specific studies to guide future research. By focusing exclusively on low-income settings and triangulating clinical, behavioural, and implementation findings, the review addresses a critical evidence gap identified in recent global digital health syntheses [13-14].

Objectives

This study aimed to:

1. Review the effects of mHealth interventions on promoting diabetes self-management behaviours.
2. Determine the effects of these interventions on diabetes-related clinical outcomes such as glycaemic control.
3. Assess the feasibility, acceptability, and effectiveness of these interventions in low-income countries.

METHODS

Design

This study followed a systematic review method and narrative synthesis of the impact of mobile health

interventions on diabetes self-management. The narrative synthesis approach was selected because of heterogeneity in intervention modalities, outcome measures, and study designs across the included literature, which precluded formal meta-analysis for all endpoints [15].

Search Strategy

The following electronic databases were searched on PubMed/MEDLINE, ScienceDirect, Springer Nature, and PLOS journals. The search strategy used keywords indicative of mHealth, diabetes, and low-income countries as indicated by inclusion criteria. Search terms included combinations of "mHealth", "mobile health", "SMS", "text messaging", "interactive voice response", "mobile application", "diabetes self-management", "glycaemic control", "low-income countries", "LMICs", and country-specific terms for sub-Saharan Africa and South Asia. Reference lists of included studies and relevant systematic reviews were also hand-searched to identify additional eligible publications.

Eligibility Criteria

To be included in this review, the studies needed to meet the following criteria:

1. Report on an mHealth intervention (SMS text messaging, IVR, application)
2. Focus on diabetes self-management
3. Include participants from low-income countries or report findings separately for low-income populations
4. Report outcomes in terms of processes or impact of interventions. Additionally, only peer-reviewed articles were included. Articles not published in English or articles that describe interventions but do not report any processes or outcomes were excluded.

Study Selection and Data Extraction

Following database screening and title and abstract screening, the full text of potentially eligible articles was retrieved and subjected to eligibility screening. Finally, ten (10) studies were included for review and data extraction. The included studies comprised two published systematic reviews and a meta-analysis on the impact of mHealth and self-management education interventions on diabetes management and a systematic review on self-management interventions delivered by peer supporters and community health workers [1-2,8]. Additionally, there were a total of six (6) primary intervention studies published in low-income countries, including South Africa, Malawi and South Africa, Egypt and Bangladesh [3-7,9]. Notably, one of the studies was a systematic review of the impact of mobile health interventions on diabetes self-management. Data on study design, setting, intervention type, sample size, follow-up duration, and key outcomes were extracted into a structured template [12].

Data Synthesis

A narrative synthesis approach was used to generate thematic insights from the reviewed literature due to the differences in intervention types, outcome domains, and follow-up lengths between the included studies. Findings were organised under three overarching themes: effects on glycaemic control, effects on self-management behaviours, and feasibility, acceptability, and implementation considerations.

RESULTS

Characteristics of Included Studies

The included studies in this review comprised two published systematic reviews and a meta-analysis on the

impact of mHealth and self-management education interventions on diabetes management and a systematic review on self-management interventions delivered by peer supporters and community health workers. Additionally, there were a total of six (6) primary intervention studies published in low-income countries, including South Africa, Malawi and South Africa, Egypt, and Bangladesh [1-9]. The included studies were published between 2017 and 2025. A summary of the primary intervention studies is presented in Table 1.

Study (Year)	Country	Intervention	Design	Follow-up	Key Findings
[7]	South Africa	Daily unidirectional SMS	RCT	6 months	No significant clinical improvement; high acceptability
[9]	South Africa & Malawi	SMS 4×/week (StAR2D)	Multicentre RCT	12 months	No significant HbA1c change; messages helpful for support
[3]	Egypt	SMS education vs paper	Pilot RCT	3 months	Improved knowledge and glycaemic trends in SMS arm
[4]	Bangladesh	Mobile reminder + call centre	RCT	6 months	Beneficial effect on glycaemic control and lifestyle adherence
[6]	Bangladesh	Smartphone self-management app	RCT	Not specified	Improved adherence to diabetes self-management

Table 1: Characteristics of primary mHealth intervention studies included in the review

As shown in Table 1, the primary studies varied in intervention intensity, delivery modality, and duration. SMS-based approaches predominated, reflecting the high penetration of basic mobile phones in low-resource settings. Sample sizes and follow-up periods were generally modest, limiting the strength of conclusions about long-term effectiveness.

Effects on Glycemic Control

The review found that the effects of mHealth interventions on glycemic control were mixed. In the StAR2D multicentre trial assessing SMS-text messaging in Cape Town, South Africa, and Lilongwe, Malawi, no significant improvement in HbA1c was found after twelve months of four times a week messages [5,9]. Similarly, in a

randomized controlled trial assessing the impact of daily unidirectional text messaging on low-income patients in Eastern Cape, South Africa, no significant improvements in blood glucose, weight, or blood pressure were found, though there were overall improvements on all measured indicators in comparison to the control group [7]. Conversely, a randomized controlled trial assessing the impact of a mobile phone reminder plus call center in Dhaka, Bangladesh, showed that the intervention had a beneficial effect on glycemic control compared to the control group [4]. Additionally, a pilot trial assessing the impact of SMS education in Cairo, Egypt, on patients' knowledge and glycaemic control compared to paper education showed improvements in the intervention group [3]. The systematic reviews of mHealth interventions and self-management education interventions also found mixed effects of the interventions on glycaemic control in low- and middle-income countries [1-2,12]. Broader

telemedicine meta-analyses covering LMICs have reported modest but statistically significant reductions in HbA1c (standardised mean difference approximately -0.30 to -0.38), although heterogeneity remains high and certainty of evidence is often rated as low [10-11].

Effects on Self-Management Behaviors

In general, the reviewed studies showed that mHealth interventions had more consistent beneficial effects on diabetes self-management behaviors than the effects on glycemic control. In the Dhaka mobile phone reminder plus call center intervention, the intervention improved adherence to diet, exercise, and tobacco and betel nut cessation [4]. Another study assessing the impact of a smartphone application found that the intervention improved adherence to diabetes self-management following the application's use [6]. Additionally, diabetes self-management education reviewed by found that across low- and middle-income countries, self-management interventions improved self-management behaviors, psychosocial, and intermediate outcomes with inconsistent effects on cardio-metabolic outcomes. Finally, peer and community health worker interventions were inconsistently associated with improved behavioral and clinical outcomes [1,8]. These behavioural gains align with findings from other digital health evaluations, which frequently report stronger effects on knowledge, self-efficacy, and adherence than on hard clinical endpoints in the short term [13-14].

Feasibility, Acceptability, and Implementation

Studies assessing the acceptability and implementation of mHealth interventions in low-income countries consistently showed that the interventions were feasible and acceptable to the participants though with mixed effects on clinical outcomes. In the Eastern Cape daily text message intervention, most participants reported being satisfied with the received SMS and that they found it helpful despite the lack of significant clinical benefit [7]. Additionally, in the StAR2D study, the process evaluation found that the participants found brief text messages helpful in addressing their informational and emotional support needs, though the intervention had no significant beneficial effect on clinical or behavioral outcomes [5]. At the same time, the studies identified several implementation barriers, including lack of consistent network coverage, shared mobile phone use, low health and digital literacy, and financial costs of airtime/data for messages [5,7]. Additionally, the systematic reviews of mHealth and self-management interventions also identified that implementation, scale-up, and sustainability of the interventions in low-income countries lacked sufficient assessment and data [2,12]. High mobile phone penetration alone does not guarantee sustained engagement; contextual factors such as language, cultural relevance, and integration with existing care pathways appear critical for long-term success [16-17].

DISCUSSION

The review findings demonstrated that mHealth interventions were generally feasible, acceptable, and moderately effective in improving diabetes self-management behaviors in low-income countries with mixed effects on glycemic control. However, the effects of mHealth interventions varied significantly depending on the type of intervention delivered. While unidirectional text messaging interventions showed mixed clinical effects, the addition of human support elements, such as a call center or interactive voice response, appeared to confer additional benefits for both diabetes self-management behaviours and glycaemic control [18-22].

For example, interventions that combined digital reminders with a call center in Bangladesh demonstrated more favorable clinical effects than single-component designs, suggesting that hybrid approaches may better address patients' informational, motivational, and practical needs. Notably, though most interventions improved self-management behaviors, these improvements rarely translated into significant improvements in glycemic control, suggesting that while these interventions helped with diabetes self-management, they were not sufficient in and of themselves to improve patients' clinical outcomes [4]. This dissociation between behavioural and clinical endpoints is consistent with broader evidence from digital health trials in LMICs, where short follow-up periods and competing structural barriers (medication access, food insecurity, and fragmented care) limit the translation of knowledge gains into sustained glycaemic improvement [2,10].

The findings also showed that acceptability and feasibility of mHealth interventions were consistently high across all the reviewed studies, with participants reporting that the interventions were helpful. Even in interventions with no significant beneficial effect on clinical, behavioral, or psychosocial outcomes, such as the daily SMS intervention in Eastern Cape and StAR2D brief SMS intervention, participants generally found them acceptable and beneficial in terms of providing support [5,7]. This indicates that while many mHealth interventions might not be immediately impactful, they are nonetheless valuable tools for diabetes care and can be integrated into the broader continuum of care, offering patients support and guidance.

The review identified several barriers to implementing mHealth interventions. First, the reviewed low-income countries had inconsistent mobile phone coverage, many residents shared mobile phones, and the participants generally had low levels of health and digital literacy. Additionally, the financial costs of airtime and data were prohibitive for many, especially in rural areas. These factors significantly impacted the participants' ability to engage fully with the interventions, especially when additional costs were required to access them [5,7]. Addressing these barriers will require not only technological solutions but

also policy attention to connectivity subsidies, digital literacy programmes, and integration of mHealth platforms into public health systems [13,16].

Additionally, while peer and community health worker interventions generally had positive effects, the evidence was inconsistent, suggesting that they might have similar issues with implementation and scale-up as other mHealth interventions. The findings suggest that the success of community health worker interventions depended on the quality of training and support and their ability to integrate into the existing healthcare ecosystem. Furthermore, most interventions reviewed were short-term, and while they had beneficial effects, these effects were often short-term as well, with no information about their long-term sustainability. Future research should prioritise hybrid models that combine digital messaging with human support, longer follow-up periods, and rigorous process evaluations to understand mechanisms of impact and pathways to scale [8,12].

LIMITATIONS

Notably, this review has several limitations. First, the review only included ten studies, most of which were short-term interventions with limited long-term follow-up. Secondly, while the majority of interventions assessed were delivered via SMS, some used voice or application, and the findings might not be generalizable to other forms of mHealth interventions. Additionally, most of the systematic reviews included in the review were published within the last five years, which means that some relevant publications might have been missed. The narrative synthesis approach, while appropriate given heterogeneity, does not provide pooled effect estimates, and residual confounding or publication bias cannot be excluded. Finally, the focus on English-language peer-reviewed literature may have omitted relevant studies published in other languages or as grey literature.

CONCLUSION

mHealth interventions were found to be effective in improving diabetes self-management behaviours, with mixed effects on glycaemic control and other clinical indicators among populations in low-income countries. The findings also identified several barriers to successful implementation, including inconsistent mobile phone coverage, shared phone ownership, low health and digital literacy, and financial costs associated with mHealth interventions. Despite these challenges, the high acceptability of simple digital tools suggests that mHealth can form a valuable component of comprehensive diabetes care strategies in resource-constrained settings, provided that interventions are culturally adapted, integrated with existing health systems, and supported by longer-term evaluation and investment in digital equity.

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