RESEARCH BRIEF

Improving Diabetes Management through mHealth Interventions in Primary Healthcare Settings of Western Rajasthan

Dr. Ramesh Kumar Huda, Scientist-D, ICMR-NIHR, Jodhpur

280	12 months	2 PHCs
Adults with T2DM	Study Duration	Study Sites, Jodhpur

BACKGROUND

Diabetes mellitus is one of the fastest-growing public health challenges globally, with a disproportionately heavy impact on Asia. More than 60% of the world's diabetic population resides in Asia, with India serving as a major contributor. The landmark ICMR–INDIAB study reported that over 72 million adults are living with diabetes in India, exhibiting substantial regional variations. Furthermore, data from the Global Burden of Disease Study highlights a doubling of diabetes prevalence between 1990 and 2016, placing immense strain on healthcare infrastructure and economies. Type 2 Diabetes Mellitus (T2DM) demands sustained self-management, strict medication adherence, and persistent lifestyle modifications. While lifestyle interventions, dietary switches, and regular physical activity have proven effective in delaying complications and lowering glycemic levels, maintaining long-term behavioral changes remains incredibly challenging in community settings. This is particularly true in resource-constrained environments where public primary healthcare systems face significant shortages of specialized personnel and limited follow-up services.

In alignment with India's National Health Policy (2017), which champions the integration of digital technologies to manage non-communicable diseases (NCDs), mobile health (mHealth) tools offer an innovative, scalable, and cost-effective avenue for optimizing primary care.

CURRENT SITUATION & POLICY GAP

Despite the existence of national programs targeting NCDs, a substantial gap persists between clinical recommendations and actual practice at the grassroots level due to:

- **Inadequate Continuity of Care:** Patients in peripheral healthcare settings often do not receive regular and structured lifestyle counselling following their initial diagnosis, resulting in limited ongoing support for effective disease management.
- **Health System Resource Constraints:** Primary Health Centres (PHCs) frequently face shortages or intermittent availability of medical officers and laboratory personnel, which hampers routine patient monitoring and timely clinical follow-up.

- **Declining Adherence to Self-Management Practices:** Sustained adherence to recommended behavioural modifications, including foot self-care, dietary regulation, medication adherence, and blood glucose monitoring, often diminishes over time without continuous motivation, reinforcement, and behavioural support.
- **Underutilization of Digital Follow-up Capabilities:** Although the MO-NPNCD portal has the functionality to deliver automated SMS reminders to ANM for pending follow-up patients, this feature remains underutilized due to the lack of integrated push messaging services from telecom operators.

ABOUT THE INTERVENTION RESEARCH

To address this gap, a 12-month cluster-randomized crossover trial was conducted between January 2024 and May 2025 across two Primary Health Centres (PHC-I and PHC-II) in Jodhpur, Western Rajasthan, evaluating 280 adults with T2DM (n = 140 per PHC).

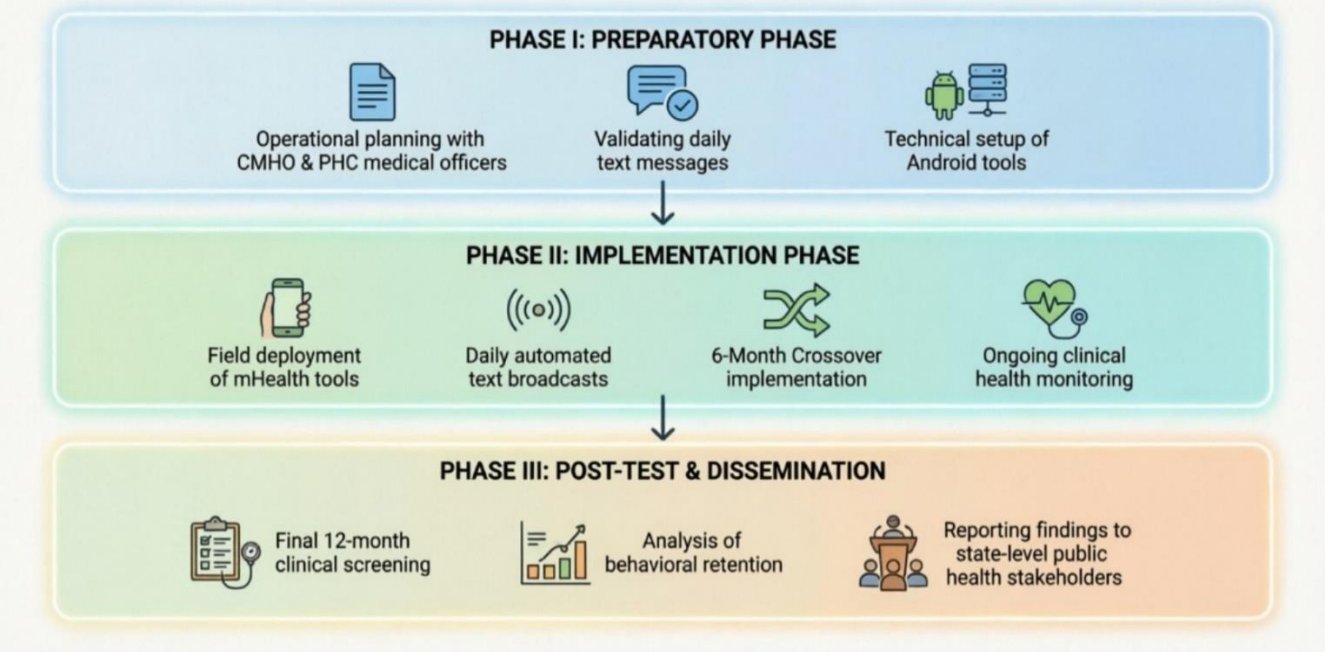
Study Design

This was a crossover intervention study. Participants enrolled at PHC-I received the mHealth intervention during the first six months, followed by six months without mHealth support. In contrast, participants enrolled at PHC-II received usual care without the mHealth intervention during the first six months and subsequently received the mHealth intervention during the following six months.

Primary Objectives:

- To evaluate the effect of the mHealth-based behaviour change intervention on glycaemic control and other health outcomes among patients with Type 2 diabetes mellitus.
- To assess the effect of the mHealth-based behaviour change intervention on diabetes-related knowledge, attitudes, and practices among patients with Type 2 diabetes mellitus.

Exhibit 1: Operational Flow of the mHealth Implementation Project



The Active mHealth Framework Components:

1. **Automated SMS Text Messages:** Structured, expert-validated automated texts delivered daily, directly targeting key self-care actions: medication adherence, physical exercise guidance, proper diabetic diet habits, regular blood glucose monitoring, etc.
2. **Android-Based Mobile Application:** A dedicated Android application installed on participants' devices by trained staff to facilitate daily compliance self-reporting and prompt real-time behavioral feedback.

Clinical indicators, including Glycated Haemoglobin (HbA1c), Body Mass Index (BMI), Blood Pressure (BP), waist circumference, and Quality of Life (QoL) using the EQ-5D framework, were tracked across baseline, 6-month, and 12-month intervals.

KEY FINDINGS

Exhibit 2: Summary of Group Clinical Screenings (PHC-I vs. PHC-II)

- **Substantial Glycaemic Control:** During the active intervention phase, participants showed significant reductions in HbA1c levels. Post-crossover in Phase II, the newly exposed group PHC-II successfully dropped their mean HbA1c from 7.70% down to 7.56%.
- **Enhanced Quality of Life (QoL):** Active mHealth deployment significantly optimized self-reported QoL. For instance, PHC-II experienced a substantial increase in QoL utility scores from 0.87 to 0.94 during their active phase ($p = 0.001$).
- **Improved Knowledge, Attitudes, and Practices (KAP):** Patients demonstrated consistently high message engagement, translating into improved self-care capabilities, enhanced awareness of diabetes risk factors, improved medication compliance, and proactive foot self-care routine practices.

Exhibit 3: Intervention Withdrawal Effects

- **The Withdrawal Effect Risk:** Crucially, when the mHealth intervention was withdrawn from PHC-I in Phase II, their glycemic control significantly deteriorated, with mean HbA1c spiked back up from 8.33% to 8.83% ($p = 0.007$), diastolic blood pressure rose, and QoL plummeted from 0.89 back to 0.86 ($p = 0.001$). These findings suggest that the benefits of the mHealth intervention may not be sustained following its discontinuation.
- **Compensating for Healthcare Infrastructure Gaps:** Notably, the intervention group achieved significant clinical improvements despite intermittent shortages of medical officers and laboratory technicians at PHC-I during the first six months, highlighting the potential of mHealth interventions to support patient care in resource-constrained settings.

POLICY RECOMMENDATIONS & WAY FORWARD

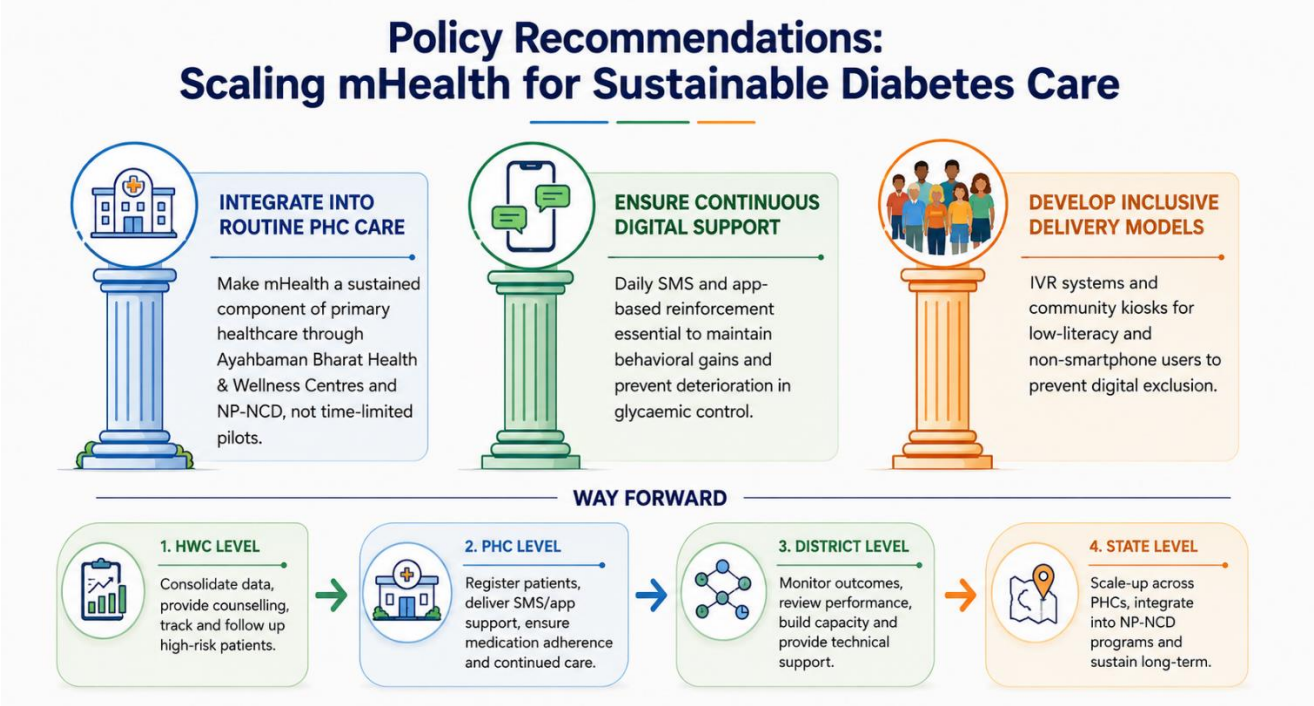
Under the Ayushman Bharat initiative, primary health facilities are being transformed into Health and Wellness Centers (HWCs) to deliver comprehensive primary health care. Based on the current research study findings in Western Rajasthan, multi-tiered digital interventions may be scaled through this existing network:

1. Codify Continuous mHealth into National NCD Protocols

mHealth text alerts and application tracking should not be treated as temporary project additions, but should instead be formally integrated into the standard treatment package for chronic diseases under national health strategies. Ongoing digital touchpoints prevent the treatment decay observed during intervention withdrawal.

2. Activate and Scale SMS Services via MO-NPNCD Portal

Fully operationalize the MO-NPNCD portal's SMS reminder functionality by securing telecom agreements to enable: (a) automated alerts to ANMs for pending patient follow-ups, and (b) Structured reminder messages to patients promoting medication adherence, follow-up compliance, dietary regulation, physical activity, and foot self-care practices. Prioritize high-risk patients and deploy content in local languages.



ACKNOWLEDGEMENT

This study was funded by the Indian Council of Medical Research (ICMR), New Delhi. The authors acknowledge the support of the Chief Medical and Health Officer, Jodhpur, the healthcare staff of participating PHCs, and all study participants.

Director
Dr. Pankaj Bhardwaj,
Director, ICMR-NIHR Jodhpur

Principal Investigator
Dr. Ramesh Kumar Huda,
Scientist-D, ICMR-NIHR, Jodhpur

Co-Investigator
Dr. Ramesh Kumar Sangwan,
Scientist-C, ICMR-NIHR, Jodhpur

Research Team
Mr. Jayvardhan Singh Rathore
Mr. Manoj Prajapati
Mr. Laxmikant Mandhana