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The Influence of Mobile Health (Mhealth) Innovations on Community Health Outreach Using the Cases of Sierra Leone and India.

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Abstract

Background: Mobile health (mHealth) technologies have emerged as critical tools for strengthening community health outreach in low- and middle-income countries (LMICs), particularly in settings affected by health workforce shortages, infrastructural constraints, and geographic barriers. While mHealth initiatives are expanding globally, evidence comparing their implementation, effectiveness, and contextual determinants across diverse LMIC settings remains limited. This study examines the influence of mHealth innovations on community health outreach in Sierra Leone and India.
Methodology: A comparative mixed-methods design was employed, combining a cross-sectional survey of 300 respondents (150 per country) with 24 Key Informant Interviews. Participants included Community Health Workers, health system administrators, and community beneficiaries. Quantitative data were analysed using descriptive statistics, inferential tests, and logistic regression, while qualitative data were analysed thematically using NVivo to explore implementation experiences, barriers, and contextual factors.
Results: mHealth awareness and utilisation were highest among Community Health Workers and administrators in both countries, with significantly higher integration and regular use observed in

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India. Perceived benefits included improved patient communication, health data tracking, referral efficiency, and patient compliance. Infrastructure-related barriers—such as poor network coverage, unreliable electricity, and limited digital literacy—were more pronounced in Sierra Leone. Logistic regression identified country context, education level, mobile phone ownership, and mHealth training as significant predictors of regular mHealth use. Qualitative findings highlighted the importance of policy integration, continuous training, and community trust in shaping adoption and sustainability.

Conclusion: mHealth innovations enhance community health outreach when embedded within supportive health systems, adequate infrastructure, and culturally responsive implementation strategies. The comparative findings underscore that technology alone is insufficient; sustainable impact depends on governance, workforce capacity, and system-level integration. These insights provide valuable guidance for policymakers and practitioners seeking to leverage mHealth to advance equitable primary healthcare in LMICs.

Keywords: Mobile health (mHealth); Community health outreach; Digital health interventions; Community health workers; Health systems strengthening; Low- and middle-income countries (LMICs); Sierra Leone; India

INTRODUCTION

The rapid expansion of digital technologies has fundamentally transformed public health practice, offering innovative pathways to address persistent health system challenges, particularly in low- and middle-income countries (LMICs). Among these innovations, mobile health (mHealth)—defined as the use of mobile phones and other wireless devices to support medical and public health objectives—has gained prominence as a scalable and cost-effective mechanism for strengthening health systems, extending service coverage, and improving health outcomes in underserved populations [1]; [2]. By enabling real-time communication, data collection, decision support, and patient engagement, mHealth interventions have become integral to contemporary community health outreach strategies.

Community health outreach remains a cornerstone of primary healthcare delivery in LMICs, particularly in rural and hard-to-reach areas where shortages of trained health personnel, inadequate infrastructure, and geographic barriers constrain access to care. Community Health Workers (CHWs) play a pivotal role in bridging these gaps by delivering preventive, promotive, and basic curative services at the household and community levels. However, their effectiveness is often limited by weak supervision, delayed reporting systems, fragmented referral pathways, and insufficient access to updated clinical information [3]. mHealth technologies have demonstrated significant potential to address these constraints by enhancing CHW performance, improving data accuracy, supporting timely referrals, and strengthening linkages between communities and formal health systems [4]; [5].

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Empirical evidence increasingly suggests that mHealth interventions contribute to improved maternal, newborn, and child health outcomes, enhanced treatment adherence, and more responsive disease surveillance systems [6]; [7]. Furthermore, mHealth aligns closely with global health priorities, including the pursuit of Universal Health Coverage (UHC) and the Sustainable Development Goals (SDGs), by promoting equity, efficiency, and continuity of care [8]. Despite these advances, the effectiveness and sustainability of mHealth initiatives remain highly context-dependent, shaped by technological infrastructure, policy environments, sociocultural norms, and levels of digital literacy.

Sierra Leone and India offer valuable comparative contexts for examining the influence of mHealth innovations on community health outreach. Sierra Leone's health system has been shaped by post-conflict recovery, recurrent public health emergencies—including the Ebola Virus Disease outbreak—and chronic underinvestment in health infrastructure. These challenges have resulted in limited health workforce density, fragile health information systems, and significant disparities in rural healthcare access [9]. In response, several donor-supported and government-led mHealth initiatives—such as mobile-based reporting platforms and emergency communication systems—have been introduced to strengthen community-level service delivery and surveillance capacities. While promising, these initiatives often face challenges related to scale-up, sustainability, and integration into national health systems [10].

In contrast, India has emerged as a regional leader in digital health innovation, underpinned by substantial investments in information and communication technology infrastructure and supportive policy frameworks. National initiatives such as telemedicine platforms, mobile-based training modules, and digital health registries have expanded the reach of health services and improved the efficiency of community health programs [11]. Nevertheless, India continues to grapple with pronounced rural–urban disparities, linguistic diversity, gendered access to mobile technologies, and uneven digital literacy, all of which influence mHealth adoption and utilization at the community level [12].

Despite growing global enthusiasm for mHealth, several critical challenges persist across LMICs. These include inequitable access to mobile devices, limited network coverage, concerns regarding data privacy and confidentiality, insufficient user training, and the proliferation of pilot projects that lack long-term sustainability or integration into national health strategies [13]; [14]. Moreover, while many studies have assessed the technical feasibility or clinical outcomes of specific mHealth interventions, fewer have adopted a comparative, multi-stakeholder perspective that captures implementation dynamics, user perceptions, and contextual determinants of success across different country settings.

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Against this background, the present study investigates the influence of mHealth innovations on community health outreach through a comparative case study of Sierra Leone and India. By employing a mixed-methods approach that integrates quantitative survey data with qualitative insights from community health workers, health system administrators, and community beneficiaries, the study seeks to: (i) examine patterns of mHealth awareness and utilization; (ii) assess perceived impacts on service delivery and health outcomes; and (iii) identify systemic, technological, and sociocultural factors shaping implementation and sustainability. Through this comparative analysis, the study aims to generate evidence-informed insights to guide policymakers, practitioners, and development partners in designing inclusive, context-sensitive, and sustainable mHealth strategies that advance health equity and strengthen community health systems in LMICs.

METHODOLOGY

Study Design

This study adopted a comparative case study design employing a mixed-methods approach to examine the influence of mobile health (mHealth) innovations on community health outreach in Sierra Leone and India. The mixed-methods design was selected to enable a comprehensive understanding of both the measurable outcomes of mHealth implementation and the contextual, experiential, and perceptual factors influencing its use across different stakeholder groups. Quantitative methods facilitated the assessment of patterns of mHealth awareness, utilization, and perceived effectiveness, while qualitative methods provided in-depth insights into implementation processes, stakeholder experiences, and systemic challenges.

A comparative case study framework was considered appropriate because it allows for systematic examination of similarities and differences across distinct national contexts, thereby enhancing analytical depth and transferability of findings to other low- and middle-income country (LMIC) settings. By analyzing two countries with differing levels of digital health maturity but shared challenges in health equity and rural healthcare access, the study offers a nuanced understanding of contextual influences on mHealth effectiveness.

Study Settings

The study was conducted in selected regions of Sierra Leone and India where mHealth interventions have been implemented as part of community health outreach programmes.

In Sierra Leone, data were collected from Kenema District, Bombali District, and Western Area Urban District. These regions were purposively selected due to their participation in pilot and scale-up mHealth initiatives, including mobile-based disease surveillance, maternal and child health reporting, and emergency communication platforms such as *mHero* and *RapidPro*. These districts also represent a mix of urban, peri-urban, and rural settings, enabling

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exploration of geographic variations in mHealth use.

In India, the study was conducted in the states of Punjab, Odisha, and Tamil Nadu, which were selected to reflect varying levels of digital health infrastructure and programme implementation. These states have implemented multiple mHealth initiatives, including *eSanjeevani* (telemedicine), *Mobile Academy* (CHW training), and the *ANMOL* application (maternal and child health tracking). The diversity of these settings allowed for comparative assessment across different health system capacities and sociocultural contexts.

Study Population

The study population comprised three key stakeholder groups involved in community health outreach and mHealth implementation in both countries:

1. Community Health Workers (CHWs): Frontline health workers who routinely use mHealth tools to deliver services, collect health data, and communicate with health facilities.
2. Health System Administrators and Implementers: Government officials, programme managers, and representatives of non-governmental organizations responsible for planning, managing, or supervising mHealth interventions.
3. Community Beneficiaries: Individuals who receive health services supported by mHealth platforms, including patients, caregivers, and household members.

Sampling Strategy and Sample Size

A multistage purposive sampling strategy was employed to ensure the inclusion of information-rich cases and diverse perspectives relevant to the study objectives. Participants were selected based on their direct involvement with or exposure to mHealth-supported community health services.

The quantitative component included a total sample of 300 respondents, evenly distributed between Sierra Leone (n = 150) and India (n = 150). Within each country, participants were further stratified by stakeholder group as follows:

- Community Health Workers: 50
- Health System Administrators: 25
- Community Beneficiaries: 75

In addition, 24 Key Informant Interviews (KIIs) were conducted—12 in each country—with programme managers, senior health officials, digital health implementers, and policy advisors. This sample size was deemed sufficient to achieve data saturation for qualitative analysis while allowing meaningful quantitative comparisons across groups and settings.

Data Collection Methods

Quantitative Data Collection

Quantitative data were collected using a structured questionnaire administered to all 300

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participants. The questionnaire was developed based on a review of existing mHealth and community health literature and consisted of both closed-ended and Likert-scale items. The instrument covered the following domains:

- Awareness and accessibility of mHealth services
- Frequency and patterns of mHealth use
- Perceived usefulness and effectiveness of mHealth tools
- Barriers to adoption and sustained use
- Perceived changes in healthcare access and service delivery

The questionnaire was pre-tested in a pilot study, and internal consistency reliability was confirmed using Cronbach's alpha ($\alpha = 0.83$), indicating good reliability. Where necessary, the tool was translated into local languages and back-translated to ensure semantic accuracy.

Qualitative Data Collection

Qualitative data were collected through semi-structured Key Informant Interviews (KIIs). An interview guide was developed to explore:

- Policy and governance frameworks supporting mHealth
- Integration of mHealth into primary healthcare systems
- Sustainability and scalability of mHealth interventions
- Training, supervision, and support for CHWs
- Community engagement, trust, and cultural acceptability

All interviews were conducted by trained researchers, audio-recorded with participants' consent, and transcribed verbatim. Field notes were maintained to capture contextual observations and non-verbal cues.

Data Analysis

Quantitative Data Analysis

Quantitative data were analysed using Statistical Package for the Social Sciences (SPSS) version 27. Initial analyses involved descriptive statistics, including frequencies, percentages, means, and standard deviations, to summarize participant characteristics and patterns of mHealth use.

Inferential analyses included:

- Independent samples t-tests to compare mean differences in mHealth utilization and perceived effectiveness between Sierra Leone and India.
- Chi-square tests of independence to examine associations between categorical variables, such as stakeholder group and frequency of mHealth use.
- Binary logistic regression analysis to identify predictors of regular mHealth use, with independent variables including country, education level, mobile phone ownership, and training in mHealth.

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Statistical significance was set at $p < 0.05$.

Qualitative Data Analysis

Qualitative data were analyzed using thematic analysis, following the six-step framework proposed by Braun and Clarke. Transcripts were imported into NVivo version 14 for systematic coding and organization. The analysis involved:

1. Familiarization with the data through repeated reading of transcripts
2. Initial open coding to identify meaningful units of text
3. Development of code categories and themes
4. Review and refinement of themes across cases
5. Interpretation of themes in relation to study objectives
6. Integration of qualitative findings with quantitative results

Triangulation across stakeholder groups and data sources enhanced the credibility and robustness of the findings.

Ethical Considerations

Ethical approval for the study was obtained from the Sierra Leone Ethics and Scientific Review Committee and the Indian Council of Medical Research (ICMR) Ethics Division. All participants received detailed information about the study and provided written informed consent prior to participation.

Confidentiality and anonymity were ensured by assigning unique identification codes to participants and removing personally identifiable information from datasets. All digital data were securely stored on password-protected and encrypted devices accessible only to the research team. Participants were informed of their right to withdraw from the study at any stage without penalty.

Methodological Rigor and Trustworthiness

To ensure methodological rigor, the study employed multiple strategies, including pilot testing of instruments, triangulation of data sources, transparent documentation of analytical procedures, and reflexive engagement by the research team. Reliability and validity in the quantitative component were addressed through standardized tools and appropriate statistical analyses, while credibility, dependability, and conformability in the qualitative component were strengthened through systematic coding, peer debriefing, and audit trails.

RESULTS

This quantitative survey included 300 respondents, with equal representation from Sierra Leone (n = 150) and India (n = 150). Participants comprised 100 Community Health Workers, 50 health system administrators, and 150 community beneficiaries. In addition, 24 Key Informant Interviews were conducted (12 per country). As summarized in Table 1, the overall mean age of respondents was 35.3 years, with Indian participants marginally older than those from Sierra Leone. Gender distribution

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was balanced across the sample. Educational attainment was higher in India, while respondents reported an average of 6.1 years of professional or service-related experience.

Table 1: Socio-Demographic Characteristics of Respondents (N = 300)

Variable	Sierra Leone (n = 150)	India (n = 150)	Total (N = 300)
Gender (Male/Female)	78 / 72	70 / 80	148 / 152
Mean Age (Years)	34.6	36.1	35.3
Education Level (%)			
– Primary	20.0	15.0	17.5
– Secondary	52.0	44.0	48.0
– Tertiary	28.0	41.0	34.5
Mean Experience (Years)	5.8	6.4	6.1

Interpretation:

The socio-demographic profile of respondents (Table 1) revealed a relatively balanced gender distribution across both countries, with 148 males and 152 females. The mean age of participants was 35.3 years, slightly higher in India (36.1 years) than in Sierra Leone (34.6 years). Educational attainment varied, with a larger proportion of respondents in India holding tertiary-level education (41%) compared to Sierra Leone (28%), while secondary education was more common in Sierra Leone (52%). Respondents reported an average of 6.1 years of professional or service-related experience, reflecting substantial exposure to community health activities across both contexts.

Table 2: Awareness and Regular Use of mHealth Tools by Stakeholder Group and Country

Stakeholder Group	**Country**	**Aware of mHealth (%)**	**Regular Use (%)**
Community Health Workers	Sierra Leone	94	88
	India	98	90
Health System Administrators	Sierra Leone	92	85
	India	96	88

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Community Beneficiaries	Sierra Leone	64	48
	India	78	60

Key Observations:

Awareness and regular use of mHealth tools were highest among Community Health Workers and health system administrators in both countries, with slightly greater levels reported in India. In contrast, community beneficiaries exhibited lower awareness and utilisation, particularly in Sierra Leone, where only 64% were aware of mHealth and 48% used it regularly. These findings indicate a clear digital divide between frontline health providers and end-users, as well as cross-country differences reflecting stronger mHealth integration in India.

Table 3: Frequency of mHealth Use by Stakeholder Group (N = 300)

Stakeholder Group	Daily Use (%)	Weekly Use (%)	Rarely Use (%)	Never Used (%)
Community Health Workers	52	28	15	5
Health System Administrators	35	42	18	5
Community Beneficiaries	20	40	30	10

Interpretation:

Frequency of mHealth use varied across stakeholder groups, with Community Health Workers reporting the highest daily usage (52%), followed by health system administrators (35%), while community beneficiaries demonstrated the lowest daily use (20%) and the highest rates of infrequent or non-use (40–10%). These patterns highlight that frontline health workers are the primary users of mHealth tools, whereas uptake among beneficiaries remains limited.

Table 4: Perceived Benefits of mHealth by Country (Mean ± SD)

Outcome Area	Sierra Leone	India
Improved communication with patients	4.2 ± 0.8	4.5 ± 0.6
Enhanced health data tracking	4.0 ± 0.9	4.4 ± 0.7

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Faster referral and follow-up	3.8 ± 1.1	4.3 ± 0.6
Increased patient compliance	3.7 ± 1.2	4.1 ± 0.9
Better emergency response coordination	3.5 ± 1.0	4.0 ± 0.8

Key Observation:

MHealth was perceived to improve key community health outcomes in both countries, with India consistently showing higher mean scores than Sierra Leone. The greatest benefits were reported for patient communication and health data tracking, while improvements in emergency response coordination were rated lowest. This suggests that mHealth is recognised as an effective tool for enhancing service delivery, particularly in contexts with stronger digital infrastructure and system integration.

Table 5: Reported Barriers to mHealth Adoption by Country (%)

Barrier	Sierra Leone	India
Limited mobile network coverage	62	28
Inadequate digital literacy	55	33
Intermittent power supply	48	19
Language/interface challenges	44	27
High device or maintenance cost	41	30

Interpretation:

Respondents reported several barriers to mHealth adoption, with infrastructure-related challenges—such as limited network coverage (62%) and intermittent power supply (48%)—being more pronounced in Sierra Leone than in India. Inadequate digital literacy, language/interface issues, and device costs were also reported, though to a lesser extent. These findings highlight that contextual factors, particularly technological and human capacity constraints, significantly influence mHealth utilisation and implementation success.

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Table 6: Logistic Regression Predicting Regular mHealth Use (N = 300)

Predictor Variable	B	SE	Odds Ratio (Exp(B))	p-value
Country (India = 1)	0.85	0.27	2.34	0.002
Education Level	0.43	0.19	1.54	0.024
Mobile Phone Ownership	1.25	0.35	3.51	0.001
Training in mHealth	0.95	0.31	2.58	0.003

Qualitative Findings from Key Informant Interviews

Thematic analysis of the KIIs yielded four dominant themes:

1. Integration into Health Systems: Indian informants reported institutionalized integration of mHealth platforms within national programmes, whereas Sierra Leonean initiatives were largely project-based.
2. Empowerment of Community Health Workers: mHealth tools enhanced efficiency, supervision, and confidence among CHWs in both countries.
3. Community Trust and Acceptance: Acceptance was higher in India, while reliance on face-to-face interactions persisted in rural Sierra Leone.
4. Training and Sustainability: Regular training and government ownership emerged as critical determinants of programme continuity.

Summing up

Overall, the results demonstrate higher levels of mHealth integration, utilisation, and perceived effectiveness in India compared to Sierra Leone. Across both contexts, CHWs and health administrators were the primary users of mHealth technologies, while community beneficiaries exhibited lower engagement. Quantitative findings were reinforced by qualitative evidence highlighting the central role of infrastructure, training, policy integration, and sociocultural acceptance in shaping mHealth outcomes.

DISCUSSION

This study examined the influence of mobile health (mHealth) innovations on community health outreach in Sierra Leone and India through a comparative mixed-methods approach. By integrating quantitative survey findings with qualitative insights from key stakeholders, the study provides robust evidence on patterns of mHealth utilisation, perceived

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benefits, barriers to adoption, and contextual factors shaping implementation. The findings underscore the transformative potential of mHealth in strengthening community health systems in low- and middle-income countries (LMICs), while also highlighting persistent structural, technological, and sociocultural constraints that influence its effectiveness.

This study results revealed high levels of mHealth awareness and utilisation among Community Health Workers (CHWs) and health system administrators in both countries, with consistently higher engagement observed in India. This finding aligns with previous studies indicating that frontline health workers are often early adopters of digital health tools due to their direct integration into service delivery and reporting responsibilities [1]; [5]. The significantly higher likelihood of regular mHealth use among Indian respondents, as revealed by the logistic regression analysis, reflects the country's more mature digital health ecosystem and sustained governmental investment in digital health infrastructure and workforce training.

In contrast, while CHWs in Sierra Leone demonstrated high awareness, utilisation among community beneficiaries remained comparatively low. This disparity reinforces evidence that mHealth adoption is uneven across stakeholder groups and that awareness alone does not guarantee meaningful use, particularly among end-users with limited digital literacy or access to mobile devices [13]. These findings support Diffusion of Innovations theory, which suggests that adoption rates vary depending on perceived usefulness, ease of use, and compatibility with existing social practices [15].

Across both countries, respondents reported positive perceptions of mHealth in improving communication, health data tracking, referral efficiency, and patient compliance. These findings are consistent with systematic reviews demonstrating that mHealth interventions enhance continuity of care, strengthen referral systems, and improve adherence to treatment protocols, particularly in maternal and child health contexts [6]; [7]. The higher mean scores observed in India across all outcome domains likely reflect stronger system-level integration, allowing mHealth tools to function as extensions of routine healthcare delivery rather than standalone pilot projects.

The qualitative findings further corroborate the role of mHealth in empowering CHWs by improving supervision, decision-making, and accountability. This echoes earlier evidence that digital decision-support tools enhance CHW confidence and performance, particularly when combined with regular training and institutional support [4]. However, the relatively lower ratings for emergency response coordination and patient compliance in Sierra Leone suggest that mHealth benefits may be constrained when digital tools are not embedded within responsive health system structures.

This study identified stark contrasts in barriers to mHealth adoption between the two countries. Infrastructure-related challenges—such as limited network coverage, unreliable electricity supply, and inadequate digital literacy—were substantially more pronounced in Sierra Leone. These findings are consistent with broader literature highlighting infrastructure deficits as a major impediment to digital health scalability in fragile and post-conflict settings [9]; [14]. Without reliable connectivity and power supply, the functionality and sustainability of mHealth

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interventions remain compromised, regardless of their technical sophistication.

In India, while barriers such as language diversity, device affordability, and digital skills persisted, their impact appeared mitigated by continuous training, multilingual platforms, and stronger institutional support. This aligns with evidence suggesting that enabling policy environments and health system readiness are critical determinants of successful mHealth implementation [11]. The regression analysis further reinforced the importance of education, mobile phone ownership, and prior training as significant predictors of regular mHealth use, underscoring the role of human and technological capital in digital health adoption.

Beyond infrastructure and policy, the findings highlight the importance of sociocultural dynamics in shaping mHealth uptake. Qualitative data revealed persistent preferences for face-to-face interactions among community beneficiaries in Sierra Leone, reflecting trust-related concerns and reliance on traditional modes of care. Similar observations have been reported in other LMIC contexts, where digital health tools may be perceived as impersonal or insufficiently aligned with local cultural norms [16].

Conversely, Indian respondents reported increasing community acceptance, facilitated by CHW-led sensitization, digital literacy initiatives, and the use of local languages within mHealth platforms. These findings reinforce prior research emphasizing that community engagement, cultural sensitivity, and participatory design are essential for building trust and promoting sustained use of mHealth technologies [12]; [17]. Trust, therefore, emerges as both a social and technological construct that must be actively cultivated through inclusive implementation strategies.

The comparative findings underscore that mHealth alone cannot address systemic weaknesses in health systems; rather, its effectiveness depends on alignment with national health priorities, governance structures, and infrastructural capacity. India's experience demonstrates how strong policy frameworks, institutional ownership, and workforce capacity-building can facilitate the transition from pilot mHealth projects to scalable national digital health platforms. In contrast, Sierra Leone's reliance on donor-driven initiatives highlights the risks of fragmentation and limited sustainability when mHealth interventions are not fully institutionalized.

For policymakers in LMICs, the findings suggest that investments in digital infrastructure, digital literacy, and CHW training are prerequisites for effective mHealth deployment. Moreover, integrating mHealth into national health information systems and primary healthcare strategies is essential to maximize its contribution to Universal Health Coverage (UHC) and health equity.

This study contributes to the growing body of digital health literature by offering a multi-stakeholder, cross-country comparative analysis of mHealth implementation in community health outreach. By combining quantitative predictors of use with qualitative insights into contextual and sociocultural dynamics, the research advances understanding of how mHealth operates within real-world health systems. The findings provide empirical support for health systems strengthening frameworks that position digital health as an enabler—rather

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than a substitute—of effective primary healthcare delivery.

Limitations and Future Research

Despite the strengths of this comparative mixed-methods study, several limitations should be acknowledged. First, the reliance on self-reported data may have introduced response and social desirability biases, potentially inflating reported levels of mHealth utilisation and perceived effectiveness. Second, the cross-sectional design limits causal inference, restricting the ability to determine whether observed improvements in community health outreach are directly attributable to mHealth interventions over time. Third, variations in sample composition, digital infrastructure, and health system maturity between Sierra Leone and India may affect the generalizability of the findings beyond the study contexts. Additionally, disparities in mobile phone ownership, network reliability, and digital literacy—particularly in rural and underserved communities—may have constrained equitable representation of beneficiary perspectives.

Future research should prioritize longitudinal and experimental designs to assess the sustained impact of mHealth interventions on health outcomes, service quality, and system efficiency. There is also a need for implementation-focused studies that examine scalability, cost-effectiveness, and integration of mHealth within national health information systems. Further qualitative inquiry should explore community trust, cultural acceptance, and gendered dimensions of mHealth use, particularly among marginalized populations. Finally, comparative evaluations across additional low- and middle-income countries would strengthen the evidence base and inform context-sensitive digital health policies aimed at advancing universal health coverage.

Conclusion

This comparative mixed-methods study provides compelling evidence that mobile health (mHealth) technologies can play a transformative role in strengthening community health outreach in low- and middle-income countries when embedded within supportive health system structures. The findings demonstrate that mHealth interventions enhance communication, data management, referral efficiency, and frontline health worker performance, with more consistent and widespread benefits observed in contexts where digital health policies, infrastructure, and workforce capacity are well established.

The contrast between Sierra Leone and India highlights that the effectiveness of mHealth is not determined by technology alone, but by the interaction of institutional readiness, digital literacy, sociocultural acceptance, and governance frameworks. While mHealth shows strong potential to bridge gaps in service delivery, its impact remains constrained in settings characterized by infrastructural deficits, fragmented implementation, and limited community engagement.

Overall, the study reinforces the view of mHealth as an enabling tool for health systems strengthening rather than a standalone solution. Sustainable impact requires strategic investment in digital infrastructure, continuous training of community health workers, integration with national health information systems, and culturally responsive implementation approaches. By offering comparative, multi-stakeholder insights, this research contributes to the growing digital health evidence base and

provides actionable guidance for policymakers and practitioners seeking to leverage mHealth to advance equitable, accessible, and resilient primary healthcare systems.

Authors' Contributions

Christian Gendemeh conceptualised the study, designed the methodology, conducted data analysis and interpretation, and drafted the initial manuscript. Professor (Dr.) Atul Khajuria provided overall academic supervision, critically reviewed the study design and methodological rigor, and contributed substantial intellectual input to the manuscript. Hannah Saidu and Feima Bockarie Gendemeh were responsible for data collection and organisation for analysis. Moses Juana Kamara led the literature review, contributed to the theoretical framework and policy implications, and critically reviewed the manuscript for coherence, clarity, and compliance with journal guidelines. All authors reviewed and approved the final manuscript and accept responsibility for its content.

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Conflict of Interest

The authors declare that they have no competing interests or conflicts of interest related to this study.

Disclaimer

The opinions expressed in this article are those of the contributors alone and do not necessarily represent the views, policies, or position of any of the institutions and/or ethics review boards with which they are affiliated.

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