





Perceptions of healthcare workers and patients on the implementation of telemedicine in hard-to-reach areas: A qualitative study from rajasthan, India

Ramesh K Huda¹ , Rahul S Chowhan^{1,*} , Simran Arora^{2,*}, Dileep Seervi^{1,*}, Sakshi Verma^{2,#}, Jayvardhan Singh^{1,#}, Sumit Kalra^{3,#}, Ashok Choudhary^{4,#}, Ramesh K Sangwan^{1,†} , Mukti Khetan^{1,†} and Bontha V Babu¹ 

Abstract

Objective: To explore the perceptions of healthcare providers and patients regarding the implementation of telemedicine in hard-to-reach areas of Rajasthan, India, and identify factors influencing its adoption and effectiveness.

Methods: A qualitative study was conducted using 24 in-depth interviews with healthcare providers from primary health centres and a district hospital, as well as patients from remote areas in Balotra district of Rajasthan. Thematic analysis was used to identify key themes related to the acceptance, benefits, challenges, and recommendations for telemedicine adoption.

Results: The acceptance of telemedicine increased, driven by cultural norms, trust, and familiarity with technology. It improved efficiency, reduced travel costs, and enhanced disease management. However, poor internet connectivity, inadequate training, and low digital literacy posed challenges. Participants emphasized the need for user-friendly systems, better infrastructure, and continuous training to improve adoption in remote areas.

Conclusion: Telemedicine can potentially transform healthcare access in remote regions of India, reducing healthcare inequities and improving health outcomes. However, addressing technical, infrastructural, and literacy challenges is essential for its successful implementation.

Keywords

Telemedicine, primary health centres, eSanjeevani, challenges in telemedicine adoption, digital health, qualitative study

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Introduction

Telemedicine has revolutionised healthcare delivery by effectively breaking down geographical barriers and significantly enhancing access to medical services. This innovative approach facilitates the swift exchange of services between hospitals and clinics nationwide, connecting patients with medical professionals and providing essential education and data access. Its versatility is evident in its wide range of applications, from basic consultations to complex medical decisions, making it an indispensable component of modern healthcare systems.¹ Telemedicine has fundamentally transformed service delivery by enabling healthcare providers to

¹National Institute for Implementation Research on Non-Communicable Diseases, Jodhpur, Rajasthan, India

²Indian Institute of Public Health Gandhinagar, Gandhinagar, India

³Indian Institutes of Technology, Jodhpur, Rajasthan, India

⁴Primary Health Centre, Siner, Balotra, Rajasthan, India

*Equal second authors.

#Equal third authors.

†Equal corresponding authors.

Corresponding author:

Ramesh K Huda, National Institute for Implementation Research on Non-Communicable Diseases, New Pali Road, Jodhpur-342 005, Rajasthan, India.

Email: ramesh.hudda@gmail.com



reach a larger population without needing physical presence. Telemedicine refers to providing healthcare services where distance is a key factor, utilizing information and communication technologies (ICTs). It involves using digital tools to facilitate the exchange of information for diagnosing, treating, and preventing diseases and injuries. Additionally, telemedicine supports research, evaluation, and the ongoing education of healthcare professionals, all aimed at improving the health of individuals and communities.²

In India, the coronavirus disease 2019 (COVID-19) pandemic has hastened the adoption of telemedicine, extending healthcare access to a diverse and widespread population. However, understanding doctors' perspectives, challenges, and experiences with this technology is crucial for its successful integration in the post-COVID-19 era. Implementing ICTs, including computers, smartphones, the Internet, and other communication devices, in digital health or eHealth initiatives offers promising opportunities to address current and future challenges related to healthcare access in remote areas.³ It is possible to reduce healthcare access inequities and provide essential medical support at the primary level by utilizing these technologies at Primary Health Centres (PHCs), thereby enhancing the reach and effectiveness of healthcare services in hard-to-reach areas. Advancements in wireless broadband technology and the widespread adoption of cell phones and the internet have further propelled the transformation of telemedicine over the past few years.⁴ These technological improvements have made patient literacy, medical image transfers, and real-time consultations more feasible via enhanced internet infrastructure and the digitization of information using electronic medical records (EMRs). The modern telemedicine framework utilizes existing computing devices and affordable, self-owned equipment, such as smartphone cameras and wearable biosensors, to collect clinical data. This user-friendly model minimizes travel expenses, conserves time, reduces medical costs, and provides convenient access to specialist care.⁵

The tertiary care centre launched in 2001 marked the inception of India's telemedicine network. By 2005, the Indian Ministry of Health and Family Welfare (MoHFW) established a dedicated task force, and SGPGIMS became the National Resource Centre for Telemedicine in 2010. The standardization of EMRs and health records began in 2012, and public-private partnerships drove telemedicine growth from 2015 to 2019.⁶

The COVID-19 pandemic accelerated telemedicine's evolution, leading to the creation of the eSanjeevani platform. This government initiative quickly expanded to provide remote healthcare, especially benefiting rural areas. Under the Ayushman Bharat programme, eSanjeevani operates on a Hub and Spoke model with two versions: 'Sanjeevani AB-HWC' for doctor-to-doctor consultations and 'eSanjeevani OPD' for doctor-to-patient services. The launch of eSanjeevani 2.0 in March 2023, incorporating point-of-care diagnostic devices, further enhanced its

capabilities, reflecting significant digital transformation in India's healthcare sector. In this context, a comprehensive understanding of the opportunities, challenges, and best practices for telemedicine adoption among patients and doctors in India is crucial for its successful integration and long-term impact on healthcare delivery.⁷

This study aims to capture stakeholder perspectives through qualitative research, focusing on telemedicine's acceptance, challenges, and potential impact in hard-to-reach areas. By engaging key stakeholders, it provides a nuanced understanding of the factors influencing telemedicine adoption. Unlike studies that predominantly examine urban and semi-urban settings, this research emphasizes the infrastructural and technological challenges faced in rural areas.⁸ It seeks to offer a comprehensive overview of telemedicine's integration into the healthcare system by assessing its benefits and identifying obstacles to widespread adoption. By analyzing stakeholder insights, this study explores strategies to enhance telemedicine implementation and improve its effectiveness in delivering healthcare services to underserved regions.

Methodology

This study utilized a qualitative research design, conducting interviews with key stakeholders to gather their perspectives on the implementation of telemedicine. The qualitative data was collected through in-depth interviews (IDIs) with healthcare providers from selected primary healthcare centres and a district hospital, as well as patients from the hard-to-reach area of the primary healthcare centres of the Balotra district of Rajasthan. Participants were selected using purposive sampling that could provide rich and diverse insights into the study topic. The sample comprised 6 Community Health Officers (CHOs), 3 Medical Officers (MOs), 7 Accredited Social Health Activists (ASHAs), 2 tertiary care level specialists, and 6 patients. The theme was considered significant if it was identified in at least ten interviews within each participant group. The rationale for selecting these groups was to capture varied perspectives on telemedicine implementation. Recruitment involved approaching potential participants through their respective health facilities or community networks. IDI guide was used during conducting IDIs. A detailed flowchart summarizing the recruitment and analysis process is provided in Figure 1.

Furthermore, the interview guides were developed through a comprehensive process involving a review of relevant literature and brainstorming sessions with experts in telemedicine and public health. Our methodology incorporated both deductive and inductive approaches. Initially, we conducted a literature review and consulted experts to identify key themes central to the study, such as telemedicine adoption, associated challenges, overall impact, stakeholder perspectives, etc.

Building on these themes, we formulated a set of guiding questions. To ensure relevance, we then tailored specific

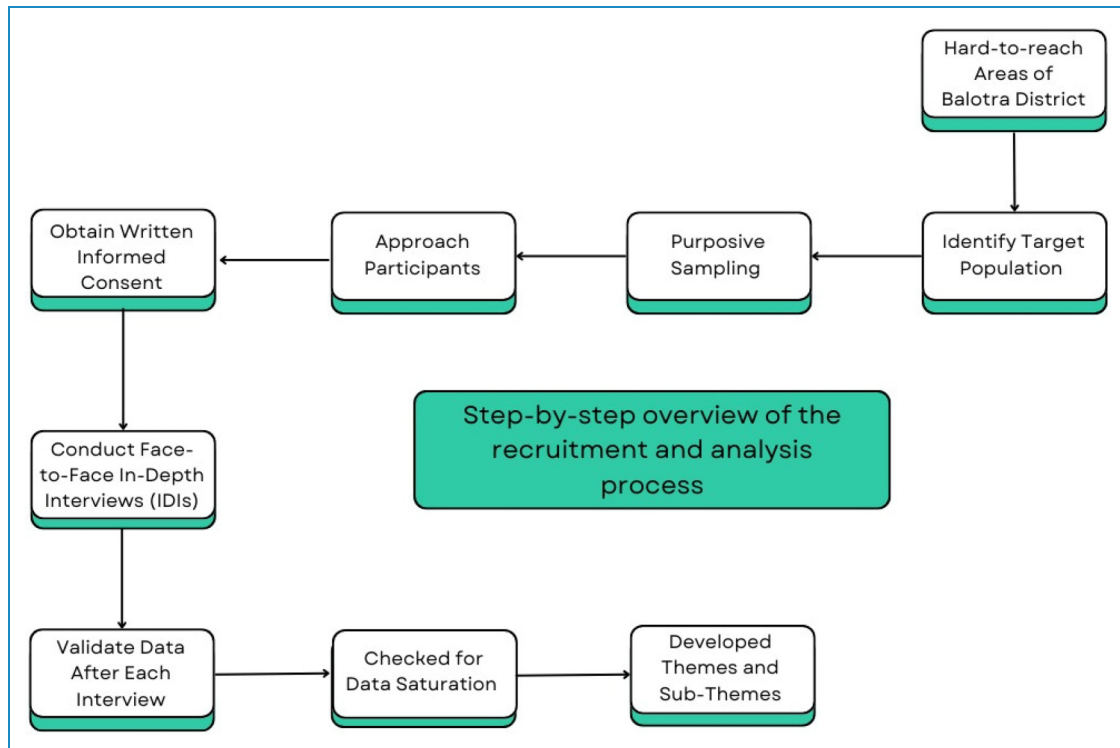


Figure 1. Recruitment and analysis process.

Table 1. Sample size and facility assessment.

Participant type	Number of IDIs	Associated health facility	Number of facility assessments
Community Health Officers	6	AAM-SHC	6
ASHAs	7	N/A	N/A
Medical Officers	3	AAM-PHC	4
Patients	6	N/A	N/A
Tertiary Care Specialists	2	District hospital	1

PHC: Primary Health Centre; ASHA: Accredited Social Health Activists.

questions for each participant group, aligning them with their roles and experiences while maintaining focus on the overarching research objectives. This structured approach enabled us to consistently explore core themes while capturing diverse perspectives from various stakeholders. Table 1 shows that purposive sampling was used, including 24 IDIs, and 11 health facility assessments were done at IDI locations.

The face-to-face IDIs were conducted after obtaining prior written consent, and no participants refused or dropped out of the study. Also, no non-participants were present during the interview. Data saturation was achieved after 24 IDIs, when no new themes or insights emerged and it was confirmed both overall and within each participant

group by analyzing the last ten interviews to ensure no new themes emerged. The data collection process was facilitated by using audio recorders and field notebooks. Thus, comprehensive data coverage was ensured by evaluating theoretical saturation, which was reached when no new themes or insights emerged, indicating exhaustive data collection. After each interview, a summary of each interview was discussed with the team, and data saturation was analyzed. The interviews were conducted in local languages (Hindi/Marwari) at quiet places to ensure comfort for both interviewer and interviewee, assuring anonymity and confidentiality. Each session, lasting approximately 20–25 min, was audio-recorded with participant consent. After each interview, a summary was read back to the

participant to validate the accuracy of the information shared, ensuring that the data accurately reflected the participants' views and experiences. The IDIs were conducted by SA and SV, both holding a BDS degree and pursuing an MPH, along with DS, a project scientist with an MBBS degree. They received training in qualitative research methods, including thematic analysis and conducting IDIs at ICMR-NIIRNCD, Jodhpur. There was no prior relationship established between the researchers and participants before the study and before conducting the interviews, participants were informed about the study's purpose, the role of the researchers, and their affiliation with ICMR-NIIRNCD, Jodhpur. The interviewers maintained neutrality throughout the interviews to minimize bias, avoided leading questions, avoided repeat interviews and adhered to a semi-structured IDI guide. The interview guide was designed based on a literature review and expert consultations to ensure consistency in data collection and facilitate open-ended discussions added as Supplemental files (Appendix A). The demographic data collected for a total of 24 participants (6 CHOs, 3 MOs, 7 ASHAs, 2 specialists, and 6 patients) during the interviews is shown in Table 2.

The research team consisted of both male and female members. The interviewers maintained a neutral stance, avoiding leading questions and ensuring consistency in data collection. They followed a semi-structured IDI guide developed through literature review and expert consultations.

The IDIs were transcribed and stored in password-encrypted files to ensure data security and confidentiality. Participants were assigned unique identification codes to anonymize the data. The transcribed scripts were translated into English to facilitate analysis. Thematic analysis was chosen as the methodological framework, employing both inductive and deductive approaches.⁹ Initially, predetermined themes derived from existing literature and the study objectives provided a structured framework for organizing the data. These themes were iteratively refined through the coding process, enhancing the depth and breadth of analysis and thematic coding was conducted by SA, SV, JSR, RSC and DS, both male and female, coders using NVivo 14 software. Following the approach, thematic analysis was employed to extract meaningful themes from the data. Each interview transcript was thoroughly reviewed, with a line-by-line analysis to identify relevant codes describing telemedicine barriers and facilitators in India.¹⁰ The analysis process began with open coding, where each transcript was carefully reviewed and segmented into meaningful units. Significant phrases, sentences, or segments related to the research objectives were identified and labelled with codes representing key concepts and ideas. These codes were then grouped into categories based on similarities and patterns observed in the data. Sub-coding further explored variations and nuances within each theme, allowing for a nuanced understanding of the complexities surrounding telemedicine implementation in the study

context. Themes were developed using inductive and deductive coding; a coding framework was used. Throughout the analysis, a constant comparison method was used to ensure consistency and to refine the themes as new data were reviewed. This iterative process enabled the emergence of new insights and the development of rich, descriptive themes that encapsulated participants' perspectives and experiences. By integrating both inductive and deductive approaches within a thematic analysis framework, the study was able to provide a 15 comprehensive and nuanced understanding of telemedicine implementation in hard-to-reach areas. Findings align with participant data, with themes supported by direct quotes. The study protocol was approved by the institutional ethics committee of the author institute.

Results

The findings of this study are directly supported by participant data, with key themes emerging from the analysis of verbatim responses. The findings are organized into four main themes: Acceptance of telemedicine, advantages and facilitators, challenges and barriers, and recommendations for implementation. Each theme reflects the detailed perspectives of various stakeholders under different sub-themes. A summary of themes, sub-themes and salient features are shown in Table 3.

Theme 1: Acceptance of telemedicine

The acceptance of telemedicine is crucial to its successful implementation and utilization. It can transform healthcare delivery, especially in remote and underserved areas, by providing timely medical consultation and treatment access. However, its acceptance among patients and healthcare providers is influenced by various factors. This theme explores the diverse dimensions that affect the acceptance of telemedicine, encompassing understanding, cultural and social factors, and practical experiences. The following are the Subthemes that emerged: 1.1: Understanding of Telemedicine, 1.2: Cultural and Social Factors, and 1.3: Utilization and Experience

Subtheme 1.1: Understanding of telemedicine. The understanding of telemedicine among participants varied, reflecting its multifaceted nature and significance in bridging the gap between patients and healthcare providers, especially when physical visits are challenging. The following verbatims illustrate the diverse perspectives on telemedicine as captured in our study:

Telemedicine is a means to obtain medications through phone consultations based on health conditions. This basic understanding highlights the convenience of telemedicine in managing health needs remotely. It connects the doctors

Table 2. Demographic data of participants.

Interview Number	Code	Role	Location	Age	Gender (M/F)	Years in practice	Education level	Avg. timing
1	MO01	Medical officer	PHC-I	28	M	1	Graduate (MBBS)	20–25 min
2	MO02	Medical officer	PHC-II	32	M	4.5	Graduate (MBBS)	
3	MO03	Medical officer	PHC-III	28	M	1	Graduate (MBBS)	
4	TCS01	Tertiary care specialist	District hospital	50	M	15	Postgraduate (MD-General Medicine)	
5	TCS02	Tertiary care specialist	District hospital	34	F	4.5	Postgraduate (MD-General Medicine)	
6	CHO01	CHO	HWC-SC-I	32	F	2	Postgraduate (GNM, MA)	
7	CHO02	CHO	HWC-SC-II	28	M	3.5	Graduate (BSc Nursing)	
8	CHO03	CHO	HWC-SC-III	31	M	2.5	Graduate (BSc Nursing)	
9	CHO04	CHO	HWC-SC-IV	29	M	2	Graduate (BSc Nursing)	
10	CHO05	CHO	HWC-SC-V	30	M	4.5	Graduate (BSc Nursing)	
11	CHO06	CHO	HWC-SC-VI	29	M	2	Graduate (BSc Nursing)	
12	ASHA01	ASHA	HWC-PHC-I	43	F	13	10th pass	
13	ASHA02	ASHA	HWC-PHC-I	33	F	5	10th pass	
14	ASHA03	ASHA	HWC-PHC-I	28	F	3	10th pass	
15	ASHA04	ASHA	HWC-PHC-I	25	F	3	10th pass	
16	ASHA05	ASHA	HWC-PHC-I	26	F	0.5	10th pass	
17	ASHA06	ASHA	HWC-SC-VI	30	F	2	10th pass	
18	ASHA07	ASHA	HWC-SC-VI	32	F	2	10th pass	
19	PT01	Patient	HWC-SC-I	50	F	NA	5th pass	

(continued)

Table 2. Continued.

Interview Number	Code	Role	Location	Age	Gender (M/F)	Years in practice	Education level	Avg. timing
20	PT02	Patient	HWC-SC-I	35	M	NA	8th pass	
21	PT03	Patient	HWC-PHC-I	51	M	NA	Postgraduate (MA, B.Ed.)	
22	PT04	Patient	HWC-SC-VI	63	M	NA	8th pass	
23	PT05	Patient	HWC-SC-VI	48	M	NA	10th pass	
24	PT06	Patient	HWC-PHC-I	38	M	NA	Postgraduate (MA)	

PHC: Primary Health Centre; ASHA: Accredited Social Health Activists.

to patients in remote areas extending the healthcare services to underserved and geographically isolated populations.

Telemedicine means getting medicines with the help of phone according to our health condition.

PT04

According to me, telemedicine is a process where if a doctor cannot reach the peripheral areas, for example, if they can't reach a remote location, like the last village, where it's difficult to reach because it's very far away, people don't come there, so through telemedicine, they can directly contact a doctor.

MO01

Subtheme 1.2: Cultural and social factors. This subtheme explores how cultural and social factors, such as gender roles, trust, and doctor–patient relationships, impact the acceptance of telemedicine. In certain cultures, women prefer consulting female healthcare workers, and often relying on female auxiliary nurse midwives (ANMs) for indirect communication. Women may feel uncomfortable speaking directly to male providers, especially around male family members, making the involvement of female healthcare workers crucial for effective communication. The necessity for a female doctor is primarily seen in women's health issues. For general health problems, the gender of the doctor is less significant. This indicates that while gender roles influence certain areas of healthcare, they may not be as critical for more general health concerns.

It depends on the situation. A female doctor is required if it's a women's health issue. For general problems, the gender of the doctor doesn't matter.

PT03

Frustration arises when doctors are often unavailable during teleconsultation attempts despite following procedures. This leads to a loss of faith in the telemedicine system. Without trust, telemedicine is ineffective because patients are unlikely to follow medical advice.

I tried many times, as instructed in a meeting. We called repeatedly, but the doctor was rarely available. After a week of unresponsive attempts, we stopped trying and gave up.

CHO06

If the patient doesn't trust the doctor and follow their advice, telemedicine won't work.

PT03

Preference for face-to-face consultations, especially among the elderly, stems from their belief in quicker relief and greater trust in in-person interactions.

Table 3. Summary of findings of themes and sub-themes.

Theme	Sub-theme	Salient finding	Similar responses
1. Acceptance of telemedicine	1.1 Understanding of telemedicine	Reflected multifaceted nature of telemedicine and its significance in the bridging the healthcare needs	18
	1.2 Cultural and social factors	Cultural and social factors, including gender roles and trust, significantly influenced telemedicine acceptance and preferences	15
	1.3 Utilization and experience	Utilization and satisfaction were affected by digital familiarity and attitudes towards technology, with telemedicine complementing traditional practices.	17
2. Advantages and facilitators of telemedicine	2.1 Time and resource efficiency	Telemedicine saved time and money by reducing travel and streamlining follow-ups, easing the workload for healthcare providers.	20
	2.2 Accessibility and convenience	Enhanced access by providing remote consultations and home-based treatment options, overcoming travel barriers.	19
	2.3 Early identification and management	Aided in early diagnosis and management, reducing infection risks and offering timely guidance in urgent situations.	16
3. Challenges and barriers of telemedicine	3.1 Network, technical issues, and time constraints	Issues like poor connectivity disrupted consultations, leading to delays and communication failures.	21
	3.2 Training and usability issues	Inadequate training and limited mobile proficiency among providers and patients hindered effective use of telemedicine platform.	18
	3.3 Lack of infrastructure and manpower	Shortages of manpower, and essential medications impacted the efficiency and reliability of telemedicine services in rural and remote areas.	20
	3.4 Limitations of Telemedicine	Lack of direct patient interactions and physical assessments affected the quality of care, especially in emergencies and specific medical fields.	14
	3.5 Education and literacy	Monotonous routines led to apathy, challenging staff commitment to telemedicine services.	17
4. Recommendation of telemedicine implementation	4.1 Monitoring and accountability	Emphasized systematic monitoring, ensuring doctors' availability, and fostering stakeholder interest to improve telemedicine reliability.	19
	4.2 Simplification and training	Focused on user-friendly systems, clear guidelines, and specialized training to boost engagement and effective implementation.	18
	4.3 Infrastructure, equipment needs and specialized services	Stressed the need for robust infrastructure, essential equipment, dedicated spaces, and reliable resources for effective telemedicine.	20
	4.4 Education and awareness	Highlighted the importance of community education, awareness campaigns, and interactive sessions to enhance understanding and adoption of telemedicine.	17

Especially among the elderly, there's a belief that seeing the doctor in person leads to quicker relief, so they tend to prefer face-to-face consultations.

PT06

When ASHAs were informed about teleconsultation, they responded enthusiastically, showing strong acceptance and readiness to implement telemedicine.

Yes, I feel confident, positive, and capable of doing it.

ASHA01

Subtheme 1.3: Utilization and experience. This subtheme highlights how often telemedicine is used, patient satisfaction, and how familiarity with technology influences its adoption. Positive experiences boost acceptance, while challenges like doctor availability and trust issues can hinder widespread use. Telemedicine supplements traditional care, allowing remote consultations after patients establish relationships with doctors.

We visit nearby towns like Jalore, Balotra, and Jodhpur for treatment and build relationships with doctors. We consult them from home for minor issues. For example, when my daughter had dengue, I sent the reports to the doctor, and he consulted with us over the phone.

PT03

Telemedicine usage varies. MOs and CHOs report one to two daily consultations, while specialist doctors see fluctuations, averaging 20–25 consultations per month, influenced by factors like COVID-19. Individuals of varying education levels now adeptly use phones for healthcare, making telemedicine a routine part of their care.

Yes, one or two patients a day seek advice. Since COVID, consultations fluctuated, averaging 20–25 monthly.

CHO02 or TCS01

Even those with less education use phones well. Once it becomes routine, there's no problem.

TCS01

Theme 2: Advantages and facilitators of telemedicine

Under Theme 2, we identified several sub-themes highlighting telemedicine implementation's positive aspects and facilitators. These sub-themes reflect how telemedicine can enhance health-care delivery and benefit both healthcare providers and patients.

Subtheme 2.1: Time and resource efficiency. Telemedicine offers time and cost savings for patients, improves follow-up efficiency, and reduces the workload for MOs. By eliminating the need for physical travel, patients save on transportation and related expenses, allowing them to

manage time more effectively, particularly for those with demanding schedules, like farmers.

A patient highlighted how telemedicine keeps them within budget by avoiding both direct and indirect costs of health care. In addition, this system avoids delays in scaling health-care and thereby avoid waiting and overstay at health facilities.

Telemedicine helps us save money and time, which we can use for farming or home tasks instead of traveling.

PT05

Telemedicine also makes follow-up care more convenient, allowing patients to discuss ongoing treatments without in-person visits, saving time and effort for both patients and healthcare providers. For chronic illnesses, telemedicine provides a flexible, comfortable option, reducing the need for frequent in-person visits.

Follow-ups are more efficient patients can call instead of visiting in person.

MO01

Telemedicine is beneficial for chronic illnesses, as it allows patients to be treated from home.

TCS01

Subtheme 2.2: Accessibility and Convenience. Telemedicine saves time and reduces travel costs by allowing patients to receive care without travelling long distances. Further, people can avoid travelling in extreme weather conditions.

With telemedicine, we don't need to travel in the heat—we can get our medicine at home.

PT01

A medical officer noted that telemedicine reduces unnecessary clinic visits for minor issues, aligning with the goal of providing home-based treatment. Telemedicine increases doctor accessibility, enabling early consultations and better health outcomes. It enhances diagnostic capabilities in resource-limited areas by enabling direct interaction between CHOs and MOs, ensuring timely treatment.

Patients who don't need to come in can be treated remotely, allowing for more home-based care.

MO01

If we don't understand something, we can directly ask the MO, benefiting the patient with a prompt diagnosis.

CHO02

Subtheme 2.3: Early identification and management. Telemedicine enables early intervention by allowing doctors to gather crucial information at the initial stages of symptoms, leading to prompt screening and treatment for diseases

like tuberculosis, breast cancer, and oral cancer. In urgent situations, telemedicine provides quick consultations and guidance, helping to prevent complications by advising patients to seek immediate care when necessary.

Telemedicine helps in triaging and guiding patients to seek urgent care, preventing delays in treatment.

TCS02

Theme 3: Challenges and barriers of telemedicine

In this theme, significant challenges and barriers to telemedicine implementation were identified. These challenges primarily pertain to network and technical issues and time constraints, which hinder the effectiveness and accessibility of telemedicine services in hard-to-reach areas.

Subtheme 3.1: Network, technical issues, and time constraints.

This subtheme identifies key barriers in telemedicine, including communication failures, delays, network issues, and technical glitches. Technical errors or language barriers often impede interaction between doctors and patients, with doctors appearing online but being unreachable due to errors or busyness.

Doctors were shown as online, but when we called, there was an error, or they couldn't respond.

CHO02

Telemedicine struggles with patient language difficulties, especially if patients are not fully literate or lack a mediator.

Sometimes patients have trouble understanding us, affecting communication.

TCS01

Technical issues and the unavailability of healthcare providers despite appearing online lead to delays, frustrating patients who face prolonged waiting times.

Patients became upset if the doctor did not attend the call promptly.

CHO06

Slow internet, lack of connectivity, and difficulties in accessing services due to poor network coverage are major barriers.

There is no internet service at the centre.

ASHA03

Network problems are severe in peripheral areas where even ANMs can't reach.

MO01

Subtheme 3.2: Training and usability issues. Training and usability challenges are key barriers to effective

telemedicine implementation in hard-to-reach areas. These issues include insufficient training for healthcare providers, limited mobile proficiency, and portal usability problems.

Healthcare providers often struggle with telemedicine due to a lack of dedicated training, leading to underutilization of the technology.

We didn't receive specific training on telemedicine, which impacted our readiness to conduct teleconsultations.

CHO02

Limited mobile proficiency among providers and patients further hampers telemedicine's effectiveness, causing delays and frustration. Healthcare providers also face difficulties with the telemedicine portal, finding it time-consuming and complicated to use.

I use my mobile phone very little and often need help from colleagues to complete tasks, I tried using the portal once, but it was a lengthy process, and I couldn't complete it.

CHO01

The resistance will be in using the portal. If they are not able to use the portal, it's too complicated; then the system will fail.

MO01

Subtheme 3.3: Lack of infrastructure and manpower. This subtheme highlights the critical barriers of insufficient infrastructure and manpower, significantly hindering telemedicine implementation. Key challenges include lacking equipment, manpower, and medication supply, reflecting broader systemic issues. Healthcare providers often rely on personal devices for teleconsultations due to the absence of government-provided equipment, leading to problems during emergencies and a lack of necessary features. The manpower shortage further complicates telemedicine implementation as overburdened healthcare workers struggle to manage additional responsibilities.

ASHAs are already overloaded with tasks, making it impractical for them to respond promptly to teleconsultation requests.

MO03

Medication management at healthcare facilities also poses challenges. Limited stock, unreliable supply chains, and lack of basic diagnostic tests restrict treatment options and impact patient care.

Doctors prescribe only what is in stock, and the lack of basic tests and reliable supplies creates significant issues.

CHO03

Subtheme 3.4: Limitations of telemedicine. Several critical limitations of telemedicine were identified, particularly diagnostic challenges due to the inability to conduct

physical exams and observe patient body language, which are crucial for accurate diagnosis. Traditional in-person visits allow for a more complete assessment, including physical examinations and the observation of body language, which are missed in telemedicine.

Traditional methods are better because they allow personal assessment and observation, which are crucial for diagnosis.

TCS02

Healthcare providers agree that in-person visits are superior for detailed exams, especially in neurology, gynaecology, and other areas where physical assessments are essential.

Physical consultations provide hands-on care that telemedicine can't fully replace, particularly in serious conditions.

TCS01

Patients also prefer face-to-face consultations for severe illnesses, where thorough examinations and tests are needed.

For serious illnesses, I would opt for face-to-face consultations for thorough exams.

PT06

Moreover, it should be in Hindi because people here understand Hindi more. They have much difficulty with English.

MO01

Subtheme 3.5: Education and literacy. This subtheme highlights barriers related to the education and literacy levels of healthcare workers and patients in telemedicine. There is limited understanding of telemedicine among healthcare workers, leading to its underutilization.

I didn't understand much about telemedicine explained in the meeting.

ASHA02

Many healthcare workers are unaware of key features like ABHA-ID integration, Hindi interface, and record-keeping on the e-Sanjeevani portal, which limits the system's effectiveness.

If the ABHA-ID was integrated, it would streamline patient care by providing doctors with a patient's history and details, improving telemedicine's effectiveness.

CHO01

Theme 4: recommendations for telemedicine implementation

This theme delves into the strategies and recommendations provided by various stakeholders to enhance the implementation of telemedicine services. The focus is on practical

steps and systemic improvements necessary for the effective functioning of telemedicine in rural healthcare settings. The following are the subthemes that emerged: (i) Monitoring and accountability, (ii) simplification and training, (iii) infrastructure and equipment needs and specialized services, (iv) education and awareness, and (v) communication.

Subtheme 4.1: Monitoring and accountability. This subtheme highlights the importance of systematic monitoring and accountability to ensure the success of telemedicine services. Key recommendations include establishing regular monitoring protocols, ensuring system-wide reach, fostering implementation interest, categorizing patients, and involving key personnel. Regular monitoring is crucial for ensuring compliance and effectiveness in telemedicine. Daily or weekly entries help maintain discipline and accountability among healthcare providers and patients. A reliable system for medical investigations and consistent availability of doctors on the telemedicine portal is necessary to maintain continuity and patient trust.

There should be a reliable system for investigations and ensuring doctor availability on the portal.

CHO03

Telemedicine requires genuine interest and commitment from all stakeholders. Even the best systems can fail at the grassroots level without active participation.

Interest and proper implementation are crucial. Without interest, it won't work, no matter who manages it.

MO02

Having MBBS doctors initially diagnose patients before referring them to specialists ensures efficient use of specialist time and resources. This pre-classification helps manage patient flow effectively.

MBBS doctors should first diagnose and then refer, saving specialists' time and ensuring timely care.

TCS01

Subtheme 4.2: Simplification and training. This subtheme emphasizes making the telemedicine system user-friendly and ensuring frontline healthcare workers, such as ASHAs, ANMs, and CHOs, receive adequate training. Simplifying guidelines, processes, and interfaces enhances usability and efficiency. Incentives can motivate healthcare workers, like ASHAs, to engage more actively in telemedicine, making the implementation more appealing.

ASHA workers should receive incentives to increase their interest and promote the service.

CHO03

ANMs play a crucial role in rural telemedicine, enhancing trust and communication between healthcare providers and patients. Their involvement is key to the success of telemedicine initiatives.

If ANM is with ASHA, it improves communication as women trust ANMs more.

CHO03

ANM's presence is beneficial for explaining things better to the community.

ASHA06

A simplified telemedicine portal with a user-friendly interface and minimal steps improves usability, especially for those with limited technical skills.

The portal should be easy to use, with minimal steps and no lag, to enhance efficiency.

MO01

Specialized training tailored to the needs of healthcare workers is essential. Small group sessions focusing on both theory and practical aspects, along with regular reviews, are recommended.

Training should be in small groups, focusing on practical aspects for effectiveness.

CHO03

Monthly training with reviews is necessary to maintain proficiency.

CHO05

Subtheme 4.3: Infrastructure, equipment needs and specialized services. Effective telemedicine implementation hinges on robust infrastructure and adequate equipment. Key requirements include doctor availability, specialist impact, sufficient manpower, necessary equipment, medication access, accurate vitals recording, and utilization of nearby health centres. In rural areas, delays in medical advice can worsen health conditions, so ensuring doctors are consistently available online is crucial for reliable teleconsultations.

There should be a reliable system to ensure doctors are available on the portal during designated times.

CHO01

Adequate manpower is crucial for telemedicine efficiency. Dedicated staff at PHCs can manage teleconsultations, allowing CHOs at HWCs to focus on direct patient care. Current understaffing, with one CHO covering multiple sub-centres, hampers service quality.

There is a shortage of manpower; one CHO covers seven sub-centers, which affects service delivery.

MO01

Providing essential equipment, such as medical instruments and dedicated consultation spaces, is vital. Creating comfortable, well-equipped rooms with technology like TVs can enhance the telemedicine experience for patients.

A dedicated room with a TV and comfortable seating is needed for effective telemedicine consultations.

CHO03

Using dedicated devices like tablets for telemedicine ensures patient data privacy and streamlines consultations.

Separate equipment like tablets should be used to keep patient data secure and separate from personal devices.

CHO02

A reliable supply of essential medicines is crucial for successful telemedicine. Ensuring the availability of specific medications as prescribed is necessary for effective treatment.

Medicines like azithromycin should be available to ensure proper treatment.

CHO05

Accurate vitals are essential for correct diagnoses and treatment plans, improving the effectiveness of telemedicine consultations.

"Having accurate vitals helps in making precise diagnoses and treatment decisions.

MO03

Subtheme 4.4: Education and awareness. Education and awareness are crucial for the effective adoption of telemedicine services. A structured approach that includes regular interactions with educated villagers, targeted awareness campaigns, and interactive sessions can enhance understanding and acceptance of telemedicine. Without widespread public awareness, only healthcare workers may be familiar with telemedicine, creating gaps in its actual usage. Utilizing local health workers like ASHAs and ANMs for education can improve public understanding and utilization.

Increasing awareness through local meetings and interactive sessions at Anganwadi centers and sub-centers, with ASHA and ANM workers present, can improve public understanding of telemedicine.

MO01

Encouraging families to download telemedicine apps through school visits and educating children about their benefits can boost adoption. Tech-savvy children can help inform their families about the convenience of telemedicine, including home consultations and prescription pickups at sub-centres. Community meetings at various levels further support participation.

By visiting schools and informing children, families can be encouraged to download telemedicine apps and use them for consultations and prescription pickups.

CHO05

Discussion

This study, conducted in the hard-to-reach areas of the Balotra district of Rajasthan, India, captured the perspective of various stakeholders on the implementation of telemedicine. This study follows the COREQ (Consolidated Criteria for Reporting Qualitative Research) checklist to ensure rigour in qualitative reporting. The completed COREQ checklist is provided as a supplementary file. Patients in remote and rural regions, greatly benefit from the convenience of receiving medical consultations without the burden of long-distance travel. This guideline is consistent with studies highlighting the importance of teleophthalmology and telerehabilitation in minimizing travel requirements and improving healthcare access.¹¹ Economic advantages also emerged as a critical facilitator. Telemedicine reduces out-of-pocket expenses related to travel, accommodation, and lost work hours, offering substantial cost savings for both patients and the healthcare system. This aligns with findings reported significant economic benefits associated with telehealth services.^{12,13} Another facilitator is the high level of acceptability and effectiveness of telemedicine for various types of consultations. Our study found that among patients and CHOs, telemedicine was highly accepted. However, MOs and tertiary care specialists showed some hesitation regarding telemedicine implementation. It is also noted high acceptance rates and positive outcomes from e-consults during the pandemic.¹⁴ Enhanced access to healthcare is another major benefit identified in our study. Telemedicine bridges the gap in healthcare accessibility, particularly for patients in underserved areas. This finding reported improved healthcare access through telepsychiatry and other telehealth services.¹⁵ Additionally, our study highlighted the role of telemedicine in reducing waiting times and improving the efficiency of follow-up consultations. This streamlining of the consultation process ensures timely and effective patient management, corroborating the findings.¹⁶

Despite these significant facilitators, our study identified several barriers that hinder the widespread implementation of telemedicine. One major barrier is the lack of reliable internet connectivity. Poor internet infrastructure in the

region hampers the effectiveness of telemedicine services.^{17,18} The absence of essential infrastructure, sufficient healthcare providers, and necessary medications poses another critical challenge. This finding is also emphasized better infrastructure and resource allocation to support telemedicine.¹⁹ Additionally, the lack of doctors on the portal for teleconsultation, technical issues, and system maintenance problems disrupt telemedicine services, impacting their reliability and usability. Similar challenges related to the technical aspects of telemedicine. Technical issues, including system maintenance problems and software glitches, were also highlighted as significant barriers in our study. These technical challenges impact the reliability and usability of telemedicine services.²⁰ A lack of awareness and training among healthcare providers and patients emerged as another barrier. Enhancing telemedicine proficiency through comprehensive training programmes is crucial.²¹ Our study also noted that telemedicine's inability to perform physical examinations and close observation is a significant limitation. Certain medical conditions require in-person evaluations, which telemedicine cannot fully replace.²² Cultural and social factors, including trust issues and digital literacy barriers, also affect telemedicine adoption. These factors' impact on the acceptance and utilization of telehealth services.²³ Privacy and security concerns are significant barriers identified in our study. Patients' fears about the privacy and security of their medical data deter them from fully embracing telehealth.¹⁸ Lastly, some healthcare providers consider telemedicine an inadequate substitute for in-person evaluation and time-consuming. These perceptions can limit the adoption of telehealth services.^{21,22}

It is essential to strengthen infrastructure by enhancing internet connectivity and digital infrastructure to effectively implement telemedicine in hard-to-reach areas. This can be achieved through government initiatives and partnerships with private entities, which can expand broadband and mobile network coverage in rural and remote regions. Improving equipment availability is equally important, ensuring that healthcare facilities are well-equipped with necessary telemedicine tools such as desktops, tablets, headphones, microphones, and HD webcams. Furthermore, standardizing protocols and providing regular training to healthcare providers on telemedicine practices is crucial for consistent and effective remote care delivery. Comprehensive training programmes should cover the use of equipment, software applications, and best practices in virtual patient care. Additionally, maintaining the functionality of telemedicine software through thorough reviews and technical support is vital to ensure seamless operations.²⁴

Enhancing digital literacy among both healthcare providers and patients is another key factor in bridging the digital divide and improving telemedicine adoption. Community-based programmes that educate individuals

in rural areas can greatly facilitate better access to and utilization of telehealth services. Developing clear regulatory frameworks is also essential to address the legal aspects of telemedicine, including privacy concerns, data protection, and cross-state licensure of healthcare providers. These frameworks should support the integration of telemedicine into the healthcare system while addressing medico-legal issues and reimbursement policies. Integrating local cultures and practices into telemedicine models can further enhance acceptance and effectiveness.²⁵ By considering local traditions and languages, patient engagement and trust can be significantly improved, and engaging local stakeholders and healthcare providers can foster greater interest and commitment to telemedicine implementation.

Expanding research and continuously monitoring the effectiveness of telemedicine and patient satisfaction are necessary to refine practices and address emerging challenges. Establishing feedback mechanisms and regular assessments can help identify ongoing challenges, measure progress, and refine strategies to enhance telemedicine delivery. Promoting public awareness and engagement through robust campaigns can also raise awareness about the benefits and availability of telemedicine services, particularly in rural areas, ensuring broader utilization and engagement. Providing incentives to healthcare providers and staff can encourage telemedicine services' adoption and sustained use.²⁶ Involving ANMs in telemedicine processes can provide crucial support and facilitate patient care.

Additionally, allocating adequate manpower, including technical and administrative support staff, is necessary for effective telemedicine operations. Ensuring the availability of doctors on telemedicine portals, balancing the use of specialists and general practitioners, and providing essential medications through telemedicine services are also critical components. Emphasizing accurately recording patients' vital signs during teleconsultations is important for effective diagnosis and treatment.²⁷ By implementing these comprehensive recommendations, telemedicine can significantly enhance healthcare accessibility and quality, becoming a cornerstone of a more equitable and efficient healthcare system in India, particularly for rural and underserved populations. This research lies in its focus on understanding the perceptions of both healthcare workers and patients specifically in hard-to-reach areas of Rajasthan, India, where healthcare access is particularly limited. While telemedicine has been studied in various settings, this study provides unique insights into its implementation in remote, rural communities, taking into account local cultural norms, social factors, and infrastructural challenges. It also highlights the critical role of user-friendly systems, continuous training, and infrastructure development to ensure the successful adoption of telemedicine in rural India, which is underexplored in the existing literature.

Limitations

The study's generalizability is limited due to its sample size, which may not fully capture the diverse perspectives of healthcare providers and patients in Rajasthan. It also does not assess the long-term sustainability of telemedicine adoption. Additionally, perceptions of healthcare providers and patients were analyzed collectively, assuming similarity in their views.

Conclusion


The study on telemedicine in Balotra, Rajasthan, shows its potential to improve healthcare access for remote areas by reducing travel and costs. High acceptance among patients and CHOs underscores its benefits, but barriers such as poor internet, infrastructure issues, and insufficient training remain. Overcoming these challenges requires better digital infrastructure, provider training, and integration of local cultural practices. While telemedicine offers a promising solution for improving healthcare access in hard-to-reach areas, its full potential can only be realized by addressing the identified challenges and implementing the study's recommendations. By doing so, telemedicine can become a cornerstone of a more equitable and efficient healthcare system in India, ultimately leading to improved health outcomes and reduced healthcare disparities for rural and underserved populations. Continued research and monitoring are necessary to refine telemedicine practices and ensure their sustainability and effectiveness in the long term.

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ORCID iDs

Ramesh K Huda  <https://orcid.org/0000-0002-1239-3660>

Rahul S Chowhan  <https://orcid.org/0000-0001-6567-4979>

Ramesh K Sangwan  <https://orcid.org/0000-0002-3127-4026>

Bontha V Babu  <https://orcid.org/0000-0001-5096-2222>

Statements and declarations

Ethical considerations

The studies involving humans were approved by the Institutional Ethics Committee, National Institute for Implementation Research on Non-Communicable Diseases, Jodhpur, India. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Informed consent/ patient consent

Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

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Conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Supplemental material

Supplemental material for this article is available online.

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