Perception and Challenges of Telemedicine - Pre and Post Covid Period

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***Abstract*—Telemedicine has revolutionized India's healthcare landscape, particularly in the wake of the COVID-19 pandemic. This transformation is rooted in ancient practices but has evolved significantly with modern digital integration. The adoption of telemedicine has been explored from the perspectives of patients, doctors, and hospitals, highlighting its benefits and challenges. Government initiatives such as eSanjeevani and Ayushman Bharat Digital Mission, alongside private players like Apollo Telehealth and Practo, have leveraged technologies like AI, IoT, and video conferencing to enable remote consultations, diagnostics, and follow-up care. While telemedicine has improved accessibility, cost-efficiency, and chronic disease management, it also faces challenges like digital divides, privacy concerns, and regulatory ambiguities. The shift from sporadic use to widespread hybrid models has been notable, with high acceptance rates among doctors. However, addressing the existing barriers through policy enhancements, infrastructure investments, and training is crucial for equitable adoption. As telemedicine becomes a cornerstone of patient-centered healthcare in India, future prospects lie in AI-driven innovations and IoT integration to reduce disparities and enhance outcomes.**

***Index Terms*—Telemedicine, Covid-19, Online Medical Assistance, eSanjeevani, Practo and Ayushman Bharat**

I. INTRODUCTION

Introduction to Telemedicine

Telemedicine has revolutionized the landscape of medical care by leveraging digital communication technologies such as video calls, mobile apps, and remote monitoring devices. This innovative approach to healthcare delivery has emerged as a critical tool during global health crises like the COVID-19 pandemic and continues to evolve, offering a range of services including remote consultations, diagnostics, and follow-up care. When examining the adoption and implications of telemedicine, it is essential to consider three key perspectives: patients, doctors, and hospitals. From these perspectives, telemedicine offers numerous advantages, including increased accessibility, convenience, and efficiency in healthcare delivery. However, it also presents several challenges that need to be addressed to ensure its widespread adoption and effective integration into existing healthcare systems. By understanding the benefits and challenges of telemedicine from the viewpoints of patients, doctors, and hospitals, we can work towards creating a more accessible, efficient, and patient-centered healthcare system that leverages the potential of digital technologies to improve health outcomes.

The definition of tele-medicine, emphasizes the role of technology in expanding access to healthcare, improving health outcomes, and advancing the well-being of individuals and communities. And describes telemedicine/telehealth, which leverages information and communication technologies (ICT) to provide healthcare services over long distances.

Features:

- Distance as a critical factor: Telemedicine bridges geographical gaps, enabling patients in remote or underserved areas to access healthcare.
- Exchange of valid information: ICT facilitates the secure sharing of patient data, medical records, and other relevant information for diagnosis, treatment, and prevention.
- Diagnosis, treatment, and prevention: Telemedicine supports a wide range of healthcare services, from consultations to monitoring chronic conditions.

- Research and evaluation: Telemedicine platforms can facilitate data collection and analysis for research and quality improvement.
- Continuing education: Healthcare professionals can use telemedicine platforms for training and professional development.

Indian Medical System - History to Present

The Indian medical system, one of the oldest and most diverse in the world, traces its origins back to ancient civilizations, where healing practices were deeply intertwined with philosophy, spirituality, and natural sciences. Emerging around 5000 BCE during the Vedic period, early Indian medicine was documented in sacred texts like the Rigveda and Atharvaveda, which described herbal remedies, surgical techniques, and holistic approaches to health. This foundational era laid the groundwork for Ayurveda, meaning "science of life," which emphasized balance among body, mind, and spirit through diet, yoga, meditation, and medicinal plants. By the classical period (circa 800 BCE to 1000 CE), often regarded as the golden age of Indian medicine, seminal texts such as the Charaka Samhita (focused on internal medicine) and Sushruta Samhita (pioneering surgery, including plastic surgery and cataract operations) were compiled, establishing eight specialized branches like pediatrics, toxicology, and rejuvenation therapy. Alongside Ayurveda, other indigenous systems evolved, including Siddha in southern India, which incorporated alchemy and mineral-based treatments, and later Unani (Greco-Arabic medicine) introduced during medieval Islamic invasions.

As centuries marched, Indian medicine reformed to cultural and political shifts. During the medieval period (roughly 1000–1700 CE), the arrival of Persian and Arabic stimuli under Mughal rule supplemented the system with Unani practices, intermingling them with Ayurvedic principles to form a pluralistic healthcare landscape. Hospitals and charitable dispensaries, some dating back to Emperor Ashoka's era (3rd century BCE), expanded, reflecting a societal commitment to public health. However, the colonial era (18th–20th centuries) marked a transformative phase, as British rule imposed Western allopathic medicine, marginalizing traditional systems through policies that favored European-trained doctors and institutions. This led to the establishment of modern medical colleges, vaccination campaigns against epidemics like cholera and plague, and the integration of missionary healthcare efforts, though it often came at the expense of indigenous knowledge.

Post-independence in 1947, India revitalized its medical heritage while embracing modernity, creating a hybrid system that includes allopathy alongside traditional practices under the Ministry of AYUSH (Ayurveda, Yoga, Unani, Siddha, and Homeopathy). The last seven decades have seen exponential growth: from just 50,000 doctors and 725 primary health centers in 1947 to a vast network serving over 1.4 billion people, bolstered by advancements in pharmaceuticals, telemedicine, and global recognition of Ayurveda's preventive focus. Today, India's medical evolution embodies resilience and innovation, blending ancient wisdom with cutting-edge technology to address contemporary challenges like chronic diseases and pandemics, while influencing global wellness trends. This rich tapestry not only highlights India's contributions to surgery, pharmacology, and holistic care but also underscores the ongoing dialogue between tradition and progress in shaping universal health.

Outlook –

Patient Perspective

From the patient's viewpoint, telemedicine represents a paradigm shift toward greater convenience and empowerment in managing health. It eliminates geographical barriers, allowing individuals in remote or underserved areas to access specialists without long travel times or associated costs. For those with chronic conditions, mobility limitations, or busy schedules, virtual visits reduce the burden of in-person appointments, minimizing wait times and exposure to infections in clinical settings. Patients often report higher satisfaction due to flexible scheduling and the ability to involve family members in consultations from home. However, not all experiences are seamless; technological hurdles, such as unreliable internet or unfamiliarity with digital platforms, can exclude older adults or low-income groups. Privacy concerns, potential miscommunications without physical exams, and the impersonal nature of virtual interactions may also lead to skepticism about care quality, underscoring the need for user-friendly tools and equitable access.

Doctor's Perspective

Doctors embrace telemedicine as a means to enhance productivity and extend their reach beyond traditional office hours. It facilitates efficient triage of cases, enabling quick assessments for non-emergency issues, chronic disease monitoring, and mental health support, while freeing up time for complex in-person procedures. Physicians can collaborate across borders, share expertise in real-time, and maintain continuity of care through integrated electronic records, ultimately improving patient outcomes. Yet, challenges persist: the absence of hands-on examinations can complicate diagnoses, increasing reliance on patient self-reporting and risking errors. Building trust and rapport virtually may feel less intuitive, and doctors often grapple with regulatory issues like cross-state licensing, varying reimbursement rates, and the mental fatigue of screen-based interactions. Despite these, many view telemedicine as an indispensable hybrid model in modern practice, provided ongoing training and supportive policies are in place.

Hospital's Perspective

Hospitals regard telemedicine as a strategic asset for operational efficiency and expanded service delivery. By integrating virtual platforms, institutions can optimize bed utilization, reduce no-show rates through reminders and easy rescheduling, and lower overhead costs associated with physical infrastructure. It supports population health management, such as remote patient monitoring for post-discharge care, which can decrease readmissions and enhance overall resource allocation. From a business standpoint, telemedicine opens revenue streams by reaching broader patient populations and partnering with rural clinics or international networks. However, implementation demands substantial upfront investments in secure technology, staff training, and compliance with data protection laws imposed by government. Hospitals must also navigate interoperability issues between systems, address digital divides to avoid exacerbating health inequities, and ensure quality control to maintain accreditation standards. In essence, while telemedicine promises scalability and innovation, hospitals approach it as a balanced investment requiring robust governance to align with their mission of comprehensive care.

II. REVIEWS OF LITERATURE

This study assessed the knowledge and perception of telemedicine among physicians in Saudi Arabia, as well as their willingness to adopt it in clinical practice. A cross-sectional survey was conducted among 391 physicians in four hospitals in Riyadh. The results showed that while 89.2% of participants owned two or more smart devices, only 46.1% had average knowledge about telemedicine technology. Despite this, 90% of physicians perceived telemedicine as a viable approach for providing medical care services, and over 90% believed that it can save time and money. However, the main issues reported in adopting telemedicine were patient privacy, high cost of equipment, lack of suitable training, and lack of consultation between IT experts and clinicians. Overall, physicians showed positive perceptions of telemedicine and were willing to adopt it in clinical practice, but highlighted the need for training and addressing the identified barriers. (Ahmed I. Albarrak,et, al. 2021)

This systematic review examines the behavioral factors that influence the acceptance of telemedicine technology among physicians. After conducting a thorough literature search across four scientific databases, 37 articles were selected based on specific inclusion and exclusion criteria. The results revealed that the Technology Acceptance Model (TAM) and its extended version were the most frequently used frameworks to study telemedicine acceptance. The key factors that affect physicians' acceptance of telemedicine include perceived usefulness, attitude to use, compatibility, perceived ease of use, self-efficacy, subjective norms, perceived behavioral control, and facilitating conditions. By understanding these factors, managers and policymakers can make informed decisions about implementing telemedicine successfully, particularly in the initial phases. Future research can build on these findings by evaluating the interplay between these factors and identifying strategies to enhance telemedicine adoption among physicians. (Ali Garavand, et, al., 2022)

This study assessed physicians' perspectives and attitudes towards telemedicine in Riyadh hospitals during the COVID-19 pandemic. A cross-sectional survey was conducted among 362 physicians, exploring their experience, willingness to use telemedicine, perceptions of patient experiences, and

influence on burnout. The results showed that physicians generally had favorable attitudes towards telemedicine, with 34% agreeing that the quality of care is comparable to face-to-face visits. Approximately 70% believed that telemedicine is cost-effective. However, burnout was reported by some physicians, with 4.1% feeling burnout every day and 27.3% a few times a month. The study suggests that telemedicine can be a valuable tool for healthcare delivery, but further research is needed to determine its long-term impact on physicians' attitudes and well-being. (Idriss S, et, al., 2022)

III. RESEARCH METHODOLOGY

Secondary research was conducted to study the various nuances of telemedicine practices in India. This research was based on the various online materials, text books and research papers. This paper aims offers conceptual discussion / understanding on the patients m doctors and hospital adaptations and acceptances.

Research Objectives

- To explore the understanding and acceptance of Telemedicine practices and process using technology.
- To evaluate the initiatives to encourage these practices by government of India and Private players.
- To understand the evolution of the telemedicine or tele-healthcare pre and post pandemic era.

Scope of the Study & Limitations

- The present study covers ways telemedicine using in the healthcare industry with help of government and private players. and
- This study covers the generic understanding and adoption among the patients with the new regulatory guidelines.
- This study planned in such a way that using available secondary data in public, focusing only healthcare industry as a whole.
- Not covering any segment or demographic or specialty of healthcare.

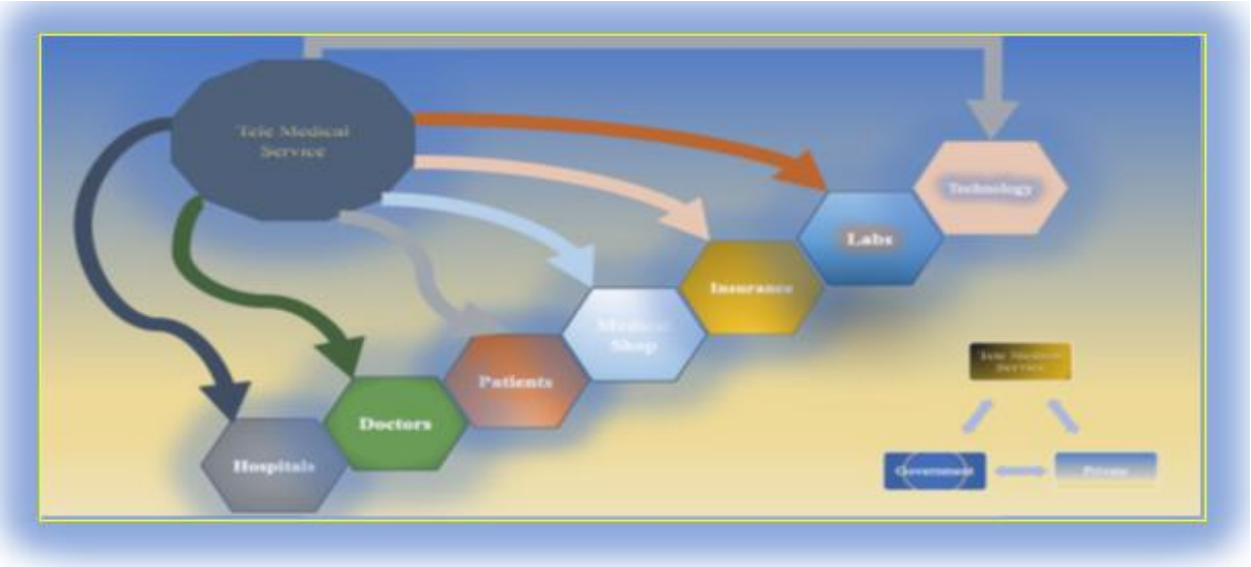
Sources of Data

Data was collected using online resources like research articles, websites, reputed blogs and other materials

IV. DISCUSSION AND FINDINGS

Mainstreaming Remote Healthcare Delivery in India

India's online healthcare system has revolutionized the way medical services are delivered, making it more accessible, affordable, and efficient. The government has launched several initiatives to promote digital health, including the Ayushman Bharat Digital Mission (ABDM), which creates a unified digital health ecosystem. This mission includes creating digital health IDs for citizens, storing health records, and promoting telemedicine and electronic health records (EHRs).



Patients' Acuities and Adoption

In India, patients increasingly view telemedicine as a practical and accessible alternative to traditional in-person consultations, particularly in rural and underserved areas where access to healthcare facilities is limited. A 2021 study revealed that perceived ease of use and usefulness significantly influence patients' intention to adopt telemedicine, with high satisfaction attributed to reduced waiting times and the convenience of accessing care from home. A cross-sectional survey of 444 Indian medical doctors reported that 60.4% of telemedicine interactions involved live audio or video consultations, highlighting its widespread use for patient engagement.

Telemedicine offers numerous benefits to India's rural population, who account for 70% of the country's residents, by reducing travel costs and time associated with in-person consultations. This is particularly advantageous for patients managing chronic conditions like diabetes, hypertension, and cardiovascular diseases, who require regular monitoring and consultations. However, patient perceptions of telemedicine vary across demographic and regional lines, with older adults and those with limited digital literacy often finding telemedicine platforms complex and difficult to use. Connectivity challenges, particularly in rural areas with inadequate internet infrastructure, pose a significant barrier to telemedicine adoption, with technological issues being the primary obstacle for 26.9% of studies. Additionally, concerns about health data security and limited insurance coverage contribute to patient apprehension, while the absence of physical examinations fuels skepticism about diagnostic accuracy. To overcome these challenges and ensure effective adoption, it is essential to develop user-friendly platforms, provide robust technical support, and implement educational initiatives to build trust in virtual healthcare delivery, alongside improvements in digital infrastructure.

Issuing Prescriptions via Telemedicine

The issuance of prescriptions through telemedicine in India, facilitated by the Telemedicine Practice Guidelines issued by the Ministry of Health and Family Welfare on March 25, 2020, has expanded access to healthcare by allowing registered medical practitioners to prescribe medications remotely. These guidelines permit doctors to issue digital or scanned copies of signed prescriptions via email or messaging platforms, provided they include the physician's registration number, patient details, and medication specifics. For chronic conditions like diabetes or hypertension, prescriptions may be issued as refills or add-ons to prior in-person consultations, but only through video consultations to ensure diagnostic accuracy. The guidelines prohibit prescribing Schedule X drugs (e.g., narcotics, psychotropic substances) via telemedicine, mandating in-person consultations for such medications to prevent abuse.

Even after several technological advancements, in issuing prescriptions while using teleconsultation, both the parties (doctors & patients) face momentous challenges. The verification of prescription authenticity poses a major hurdle, as digital prescriptions can be manipulated or reused, potentially leading to drug misuse or abuse, particularly for Schedule H and H1 drugs like antibiotics. A 2022 study highlighted that the absence of robust mechanisms to validate patient identity and prescription legitimacy increases risks of self-medication and overuse, contributing to public health concerns like antibiotic resistance. Regulatory ambiguities persist, as the Drugs and Cosmetics Act, 1940, and its Rules, 1945, do not explicitly address online prescription issuance, creating uncertainty for physicians. The requirement to maintain digital records for three years, including patient history and consultation logs, imposes additional administrative burdens. Privacy concerns also arise, as patient data shared via telemedicine platforms must comply with the Information Technology Act, 2000, yet many platforms lack robust cybersecurity measures. Furthermore, the prohibition on prescribing certain medications without video consultations limits telemedicine's scope for acute or complex cases, necessitating hybrid care models. Addressing these challenges requires enhanced digital verification systems, standardized regulations, and improved cybersecurity to ensure safe and effective prescription practices.

Comparison of Pre-COVID and Post-COVID Practices for Patient Advisory in Medical Treatment Follow-Up

Patient advisory for medical treatment follow-up in India has undergone a significant transformation due to the COVID-19 pandemic, shifting from predominantly in-person interactions to a hybrid model incorporating telemedicine. This section provides a detailed comparison, highlighting key differences in practices, adoption rates, benefits, and challenges, supported by relevant data and references.

Pre-COVID Practices

Prior to the COVID-19 pandemic, patient advisory and follow-up were largely reliant on traditional in-person visits, which posed substantial barriers in a country with a doctor-to-population ratio of approximately 0.62:1000 and a heavy concentration of healthcare facilities in urban areas (about 75% of doctors). Telemedicine was used sporadically, primarily in rural or disaster-prone areas, initiated by organizations like the Indian Space Research Organization (ISRO) since 2001. However, adoption was limited due to legal uncertainties, lack of standardized guidelines, inadequate infrastructure, and low digital literacy. Follow-up care for chronic conditions, such as diabetes or hypertension, often required physical travel, leading to higher costs, time consumption, and non-compliance rates. Studies indicate that telemedicine was viewed as cumbersome and expensive, with minimal integration into routine advisory practices. For instance, early initiatives like the Aragonda project by Apollo Hospitals linked rural areas to urban centers but served only a small fraction of the population.

Post-COVID Practices

The pandemic accelerated telemedicine adoption, with the issuance of the Telemedicine Practice Guidelines on March 25, 2020, providing a legal framework for remote consultations. Post-COVID, patient advisory and follow-up have increasingly utilized digital platforms for non-emergency care, reducing infection risks and improving accessibility. Platforms like Practo reported a 4x increase in daily patient advisories, while myUpchaar saw a 3x jump in consultation requests. A 2024 cross-sectional study of 444 doctors found that 60.4% of interactions involved live audio/video consultations, with 93% recognizing telemedicine's role in risk reduction. For follow-up in specific fields:

- Orthopedics: Telecalls effectively managed follow-ups for back and cervical pain, accounting for over one-third of cases.
- Respiratory illnesses: 80% caretaker satisfaction in pediatric follow-ups.
- Chronic diseases: Telemedicine facilitated regular monitoring for diabetes and hypertension, with projects like the Chunampet Rural Diabetes Prevention Initiative providing comprehensive screening and follow-up.
- Oncology: Networks in Kerala handled over 10,000 cancer patients annually for regular advisories.

The market is projected to reach $5.4 billion by 2025, growing at a 31% CAGR, reflecting sustained post-pandemic interest as per Google Trends data showing higher search volumes in 2020 that remained elevated.

Comparison Table

Aspect	Pre-COVID Practices	Post-COVID Practices
Adoption Rate	Low (sporadic use, ~10-20% anecdotal in rural areas)	High (60-93% doctor utilization; 4x-3x surge in consultations)
Primary Mode	In-person visits; limited tele-use in disasters/rural projects	Hybrid: Video/audio consultations (60.4%); smartphones (60.6%)
Benefits	Reduced travel in pilot projects; basic access in remote areas	Risk reduction (93%); cost/time savings; high satisfaction (80% in respiratory care)
Challenges	Legal gaps; poor infrastructure; low literacy; high costs	Insurance fragmentation (45%); privacy concerns; digital divide; verification issues
Follow-Up Examples	Physical check-ins for chronic conditions; high non-compliance	Remote monitoring for diabetes/cancer; tele-oncology for 10,000+ patients/year

The shift post-COVID has bridged geographic gaps, particularly for rural populations (70% of India), by enabling proactive advisory for chronic conditions without travel. However, challenges like connectivity in rural areas and insurance limitations persist, potentially exacerbating disparities. Future enhancements in infrastructure and training could solidify telemedicine's role. References indicate sustained high interest, with telemedicine poised for integration into standard care.

Merits and Challenges of Telemedicine in India

Telemedicine, leveraging digital technologies for remote healthcare delivery, has seen significant growth in India, particularly post-COVID-19, with platforms like eSanjeevani facilitating millions of consultations. While it addresses critical gaps in a country with vast rural-urban disparities and a doctor-patient ratio of about 1:1,445, it also faces hurdles in implementation. Below is a compilation of key merits and challenges, drawn from recent studies, reviews, and analyses as of 2025.

Merits of Telemedicine

Enhanced Accessibility: Telemedicine bridges geographical barriers, enabling rural and remote populations to access specialist care without travel, promoting "health for all" and reducing urban-rural healthcare inequities. For instance, it supports underserved areas through initiatives like the Chunam pet Rural Diabetes Prevention Project.

Cost-Effectiveness and Efficiency: It lowers treatment costs, eliminates unnecessary travel, and saves time for patients and providers, making healthcare more affordable and reducing hospital overcrowding. This is particularly beneficial during pandemics, where it minimizes infection risks and supports forward triage.

Improved Patient and Provider Satisfaction: High satisfaction rates (e.g., 82% among patients) stem from convenient follow-ups, instant advice on medications, and flexible scheduling, enhancing overall care quality. It also aids in managing chronic conditions like diabetes and mental health issues, reducing stigma.

Support for Specialized and Preventive Care: Enables tele-education for healthcare workers, early detection of diseases (e.g., cancer, rheumatic heart disease), and real-time epidemic response, improving outcomes in non-communicable diseases. Legal frameworks like the 2020 Telemedicine Practice Guidelines (TPG) provide nationwide practice rights for registered practitioners.

Innovation and Scalability: Integrates with national initiatives like Ayushman Bharat Digital Mission, offering modes like video/audio consultations and supporting new/follow-up care across specialties such as dermatology and ophthalmology.

Challenges of Telemedicine

Digital Divide and Infrastructure Gaps: Limited internet connectivity, smartphone access, and digital literacy, especially in rural and hilly areas, exacerbate inequities, affecting lower socioeconomic groups and older adults. Unreliable bandwidth hinders video consultations.

Quality and Diagnostic Concerns: Absence of physical examinations risks misdiagnosis, particularly in specialties requiring hands-on assessment, with issues like poor image quality in tele-diagnostics. Providers may lack training in telehealth platforms.

Legal, Ethical, and Privacy Issues: Ambiguities in consent, data security, and liability (e.g., cross-border laws, medicolegal risks) deter adoption, with concerns over privacy in shared environments and inadequate record integration. TPG limitations exclude non-doctors and restrict certain prescriptions.

Socio-Cultural and Acceptance Barriers: Preference for in-person visits, especially among patients and public-sector doctors viewing it as extra workload, reduces uptake; vulnerabilities for groups like women with disabilities persist. Limited empathy in virtual interactions affects patient-provider relationships.

System-Level Hurdles: Insufficient funding, lack of experts (e.g., in radiology), and challenges in sustainability/integration with existing systems, including reimbursement policies and standardization across regions. Issues like long wait times and appointment difficulties further complicate usage.

Telemedicine Service Initiatives in India: Government and Private Players

Telemedicine, the remote delivery of healthcare services using digital technologies like video consultations, mobile apps, and AI-driven diagnostics, has transformed India's healthcare landscape, especially amid the COVID-19 pandemic and ongoing rural-urban disparities. With a doctor-patient ratio of about 1:1,445 and over 70% of the population in rural

areas, telemedicine addresses accessibility, affordability, and efficiency. As of 2025, the Indian telemedicine market is valued at approximately USD 1.54 billion, projected to grow at a CAGR of 20.75% to reach USD 19.90 billion by 2033, driven by government policies, private innovations, and infrastructure expansions like 5G and BharatNet. This discussion details key initiatives by government and private players, highlighting their scope, impact, and collaborations.

Government Initiatives

The Indian government has spearheaded telemedicine through the Ministry of Health and Family Welfare (MoHFW), Indian Space Research Organisation (ISRO), and initiatives under the National Digital Health Mission (NDHM). These programs focus on universal health coverage (UHC), integrating telemedicine into public health systems like Ayushman Bharat, and leveraging technology for rural outreach. Key guidelines, such as the Telemedicine Practice Guidelines (2020) by the Board of Governors of the Medical Council of India (now National Medical Commission), formalized its use, ensuring ethical practices, data privacy, and e-prescriptions.

Below are major initiatives:

eSanjeevani (National Telemedicine Service): Launched in 2020 by MoHFW, this is India's flagship free telemedicine platform, operating on a hub-and-spoke model. "Spokes" are primary health centers (PHCs) and Ayushman Bharat Health and Wellness Centres (AB-HWCs) equipped with basic IT for initial assessments by community health officers (CHOs) or mid-level providers. "Hubs" connect to specialists in district/state hospitals for video/audio consultations. By mid-2025, it has delivered over 276 million consultations, with daily averages of 200,000, covering specialties like general medicine, gynecology, and pediatrics. Integrated with ABDM for digital health records, it supports e-prescriptions and follow-ups. Challenges include dropping footfall due to inadequate training and integration of general practitioners, but enhancements like AI triage and multilingual support are underway. Impact: Reduced travel costs by 50-70% for rural patients and improved chronic disease management.

Ayushman Bharat Digital Mission (ABDM): Rolled out in 2021 as an evolution of NDHM, ABDM creates a unified digital health ecosystem with unique health IDs (ABHA) for over 1 billion Indians. Telemedicine is core, enabling seamless data sharing across platforms like eSanjeevani, CoWIN, and e-Hospital. It includes the Unified Health Interface (UHI) for interoperable teleconsultations and incentives for private providers to join (e.g., via APIs). By 2025, it has digitized records for 500 million users, facilitating telemedicine in remote areas. Collaborations with states like Uttar Pradesh for Kumbh Mela 2025 health services highlight its scalability.

Tele-MANAS (National Tele Mental Health Programme): Launched in October 2022, this 24/7 helpline (toll-free: 14416 or 1-800-891-4416) addresses mental health gaps, offering counseling in over 20 languages via 53 centers. It uses IVR for triage, connecting callers to psychologists or psychiatrists for teleconsultations. By 2025, it has handled millions of calls, focusing on stress, anxiety, and suicide prevention, integrated with eSanjeevani for referrals. Impact: Bridged urban-rural divides, with a 90% increase in timely interventions per Lancet studies.

ISRO's Telemedicine Network: Pioneered in 2001 with a pilot linking Apollo Hospitals, ISRO has expanded to connect 45 rural hospitals with 15 super-specialty centers using satellite technology. Initiatives like Village Resource Centres (VRCs) provide telemedicine alongside e-governance and education. It supports specialties like cardiology and ophthalmology, with mobile units for disaster response.

Other Programs:

- Nikshay 2.0: For TB management, integrating telemedicine for monitoring.
- National Medical College Network: Links medical colleges for tele-education and consultations.
- BharatNet: Aims to fiber-connect all villages by 2025, enabling high-speed telemedicine.
- National Rural AYUSH Telemedicine Network: Promotes traditional medicine virtually.

These initiatives are funded under schemes like Ayushman Bharat (₹105.9 crore for telehealth in 2024-25), emphasizing equity and integration with EHR standards.

Private Sector Initiatives

Private players dominate urban adoption, offering user-friendly apps, AI integration, and partnerships with insurers/pharmacies. Valued at USD 10.6 billion by 2025, the sector focuses on scalability, with companies like Apollo leading in rural outreach via public-private partnerships (PPPs). Major players include:

Company	Key Features	Impact/Scale (as of 2025)
Apollo Telehealth	Video consultations, tele-ICUs, remote monitoring; partnerships with ISRO and governments for rural clinics. Offers corporate packages and chronic care management.	Operates in 100+ countries, 20+ years; 5 digital dispensaries in Madhya Pradesh; millions of consultations annually.
Practo	AI-powered app for bookings, virtual consultations, e-prescriptions; integrates with labs/pharmacies.	100+ cities, 1 lakh+ doctors; 4.7/5 app rating; focuses on urban users.
MFine (now part of Reliance Health)	On-demand AI consultations, hospital linkages; chronic disease tracking.	High rural penetration via partnerships; rapid growth post-COVID.
Tata 1mg	E-pharmacy with teleconsults, lab tests, health content; affordable plans.	Covers 1,000+ cities; 4.7 app rating; focuses on preventive care.
PharmEasy	Teleconsults, medicine delivery, diagnostics; super app model.	1,000+ cities; collaborations for e-clinics in rural areas.
Netmeds	Virtual consultations, discounts on meds; loyalty programs.	Strong in semi-urban areas; 4.7 app rating.
Other Notable: TeleVital, DocOnline, Lybrate, Dhanush Healthcare	Real-time monitoring, EHR integration; focus on specialties like cardiology.	Emerging with AI tools; partnerships for underserved regions.

Private initiatives often collaborate with government, e.g., PayNearby and M-Swasth launched 3,800 e-clinics in 2025 for rural women. Companies like Philips provide hardware for telehealth platforms.

Public-Private Partnerships and Challenges

PPPs are pivotal, e.g., Apollo with ISRO for rural networks, or Practo integrating with ABDM. The World Economic Forum's Digital Healthcare Transformation Initiative showcases India's model globally. Challenges include digital divide (e.g., low rural internet), privacy concerns under DPDP Act 2023, and misdiagnosis risks. Future prospects: AI integration, 5G expansion, and reaching 100% village connectivity by 2025.

In conclusion, government initiatives prioritize equity and scale, while private players drive innovation and convenience, collectively advancing India's digital health goals.

Technologies Used in Telemedicine Services in India

Telemedicine in India leverages a blend of digital tools, mobile applications, and advanced technologies to deliver remote healthcare, particularly addressing the challenges of a vast population and uneven infrastructure. As of 2025, the ecosystem has evolved significantly, integrating artificial intelligence (AI), Internet of Things (IoT), and secure data systems to enhance accessibility and efficiency. Key technologies include:

- Video and Audio-Conferencing Platforms: Core to consultations, these use apps like eSanjeevani's hub-and-spoke model, where primary health centers (spokes) connect to specialist hubs via video/audio. Android and iOS devices are predominant, with about 60% of doctors using them for consultations. Tools like Zoom, Google Meet, or proprietary apps (e.g., Practo, Apollo Telehealth) support real-time interactions, e-prescriptions, and triage.
- AI and Machine Learning: AI powers diagnostics, triage, and predictive analytics. For instance, AI-

driven tools in eSanjeevani assist in specialist referrals and early detection of conditions like diabetes or respiratory issues. Initiatives in remote areas use AI for image analysis in dermatology or radiology, bridging specialist shortages. By 2025, deeper AI-IoT integration enables autonomous care pathways.

- Wearable Devices and IoT: Self-monitoring tools like fitness trackers, glucose monitors, and ECG devices transmit real-time data to providers. These are integrated into m-health apps for chronic disease management, such as hypertension or diabetes. IoT enables remote patient monitoring (RPM) in programs like Tele-MANAS for mental health.
- Blockchain and Data Security: Emerging by 2025, blockchain secures electronic health records (EHRs) and ensures privacy in apps under the Ayushman Bharat Digital Mission (ABDM). It facilitates secure data sharing across platforms, complying with the Digital Personal Data Protection Act 2023.
- Satellite and Point-of-Care Diagnostics: ISRO's satellite networks connect rural clinics to urban specialists, supporting video feeds and data transmission. Portable diagnostic devices (e.g., for blood tests or ultrasounds) integrate with apps for instant results.
- Other Innovations: Robot-assisted surgery, virtual assistants, big data for epidemiology, and electronic medical records (EMRs) for seamless consultations. The ABDM's Unified Health Interface (UHI) standardizes interoperability.
- These technologies are supported by 5G rollout and BharatNet for high-speed connectivity, driving the market's growth at a CAGR of 23.8% from 2025 to 2030.

Acceptance and Resistance

Telemedicine's reception in India varies, with acceptance growing due to proven benefits, but resistance persists from infrastructural, cultural, and professional hurdles. Studies from 2025 highlight a nuanced landscape, often using frameworks like Technology Acceptance Model (TAM) to analyze factors.

Among Patients

Acceptance: High in rural and chronic care groups, driven by cultural norms, trust in providers, and tech familiarity. A Rajasthan study showed increased efficiency and reduced travel as key positives, with 70-80% satisfaction for follow-ups. Patients trust telehealth more when knowing the doctor, leading to 59% preference for chronic management. Telepsychiatry sees 90% timely interventions, reducing stigma.

Resistance: Barriers include digital literacy gaps, privacy fears, and preference for in-person exams (risk of misdiagnosis). Rural inhibitors: Poor internet, cultural gender roles, and lack of empathy in virtual interactions. A 2025 study found discontinuation in telepsychiatry due to tech issues and unmet expectations. Overall, 20-30% resist due to distrust in remote diagnostics.

Among Doctors

Acceptance: As quoted in a study, doctors in specialty medicine field 74% of (e.g., Cardiology) find it suitable for non-emergencies, with confidence rising post-training. Benefits like workload efficiency and reimbursement policies boost adoption ($\chi^2 = 14.91$, $p = 0.008$). A 2025 ANOVA study showed improved perceptions in diagnosis and management. Awareness of guidelines is high (74%), aiding integration.

Resistance: Staff resistance stems from budget constraints, lack of training, and medicolegal risks in resource-limited settings. Doctors cite tech glitches, inability for physical exams, and extra workload as barriers. In public sectors, resistance is higher due to infrastructure gaps.

Aspect	Acceptance Factors	Resistance Factors
Patients	Convenience, cost savings, trust in known providers, cultural alignment	Digital divide, privacy concerns, preference for physical interaction
Doctors	Training, reimbursement, efficiency in non-complex cases	Lack of hands-on assessment, tech unreliability, legal ambiguities

Overall, acceptance outweighs resistance (60-80% positive), but targeted interventions like training and infrastructure upgrades are essential for broader uptake.

V. CONCLUSION

The adoption of telemedicine among patients and physicians presents a complex balance of opportunities and challenges. On one hand, patients appreciate the convenience and accessibility it offers, particularly in overcoming geographic and infrastructural barriers. However, they face obstacles related to digital literacy, connectivity, and trust in virtual platforms. Physicians, on the other hand, value telemedicine's potential to enhance efficiency and reach underserved populations, but they encounter diagnostic limitations, regulatory complexities, and reimbursement challenges. To achieve widespread adoption, stakeholders must address digital disparities by improving internet connectivity, enhancing platform usability, and establishing robust policy frameworks. The 2020 Telemedicine Practice Guidelines have initiated this process, but continued government support, such as subsidies for private telemedicine initiatives and investments in digital infrastructure, will be crucial. Furthermore, the issuance of prescriptions via telemedicine, while a significant step forward, is hindered by verification issues, regulatory gaps, and data security concerns, which need to be addressed.

Technological advancements progress, helps to dive in to a new dimension in this field. Telemedicine is poised to become a foundation of patient-centered, accessible healthcare delivery, bridging gaps in the diverse healthcare ecosystem. In India, telemedicine has the potential to transform the healthcare landscape, but addressing challenges through policy enhancements, infrastructure investments, and training is crucial for equitable and sustainable adoption. With the right support and infrastructure in place, telemedicine can become an integral part of India's healthcare system, providing high-quality care to patients across the country.

VI. FUTURE PROSPECTS:

The future of healthcare is poised to be transformed by several key technologies. Artificial Intelligence (AI) will play a significant role, with AI-driven diagnostics and predictive analytics enabling early disease detection, personalized treatment plans, and improved patient outcomes. The Internet of Things (IoT) will also have a profound impact, as wearable devices and sensors track vital signs and health metrics, enabling remote monitoring and empowering patients to take a more active role in their care. Furthermore, telemedicine will continue to grow, increasing access to healthcare services, especially in underserved areas, and reducing healthcare disparities. The convergence of these technologies will create a more patient-centered, efficient, and effective healthcare system.

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