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TELEMEDICINE AND ITS IMPACT ON HEALTHCARE ACCESSIBILITY: A STUDY OF INDIA AND GLOBAL PRACTICES

MD SOHAIL AKHTER¹, Dr. Anamita Guha²

22GSOB1110112 Section-18 6th Sem ² Under the guidance

² Under the guidance of Assistant Professor Department of Communication, School of Business Galgotias University

ABSTRACT

Telemedicine – clinical care provided remotely using information and communications technology (ICT) – has developed rapidly, especially in the wake of the COVID-19 pandemic. This report examines the effect of telemedicine on healthcare access in India and compares it with that of the USA, Brazil, and Kenya. Based on secondary data from WHO, the government, and peer-reviewed journals, we make a comparison of policy landscapes, infrastructure, and usage rates.

India's national free telemedicine platform (eSanjeevani) has conducted over 276 million consultations (pubmed.ncbi.nlm.nih.gov). However, rural connectivity as well as system design issues continue. In the USA, some 37% of adults in 2021 were estimated to have used telemedicine (cdc.gov), and nearly 87% of the hospitals provide telehealth services (aha.org).

Brazil's legalization of telemedicine during COVID-19 (pmc.ncbi.nlm.nih.gov) led to rapidly increasing adoption, but digital divides (53% rural internet penetration) hinder equality (pmc.ncbi.nlm.nih.gov).

Kenya experiences acute provider shortages (≈ 26 physicians/100,000) and $\sim 41\%$ internet penetration in isolation (2024) (transformhealthcoalition.org, m.economictimes.com).

Whereas its digital health strategy emphasizes UHC via telehealth, policy innovations of the country target universal access.

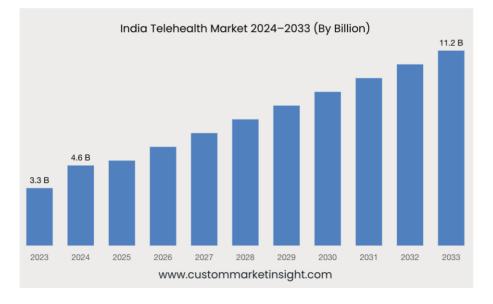
Interpreting findings in the context of infrastructure, regulation, and population needs, in discussion, we propose a novel hybrid model of care by merging mobile healthcare workers with telemedicine platforms to optimize coverage in under-served areas. Policy innovations like these, with strong training and feedback mechanisms, are necessary to catalyze telemedicine for universal healthcare access.

List of Symbols/Abbreviations

- CDC Centers for Disease Control and Prevention
- ICT Information and Communications Technology
- LMIC Low- and Middle-Income Country
- MoH Ministry of Health
- UHC Universal Health Coverage
- WHO World Health Organization

Chapter 1: Introduction

Telemedicine has emerged as a transformative solution in global healthcare, enabling remote medical consultations, diagnostics, and treatment. The increasing burden on traditional healthcare systems and the need for accessible, cost-effective solutions have accelerated the adoption of telemedicine worldwide (WHO, 2023). In India, the COVID-19 pandemic catalyzed digital healthcare expansion, supported by policies such as the National Digital Health Mission (NDHM) and the Telemedicine Practice Guidelines (2020) (IMARC, 2024). This literature review synthesizes research on telemedicine's evolution, regulatory landscape, adoption trends, challenges, and future prospects, with a focus on India and global markets.

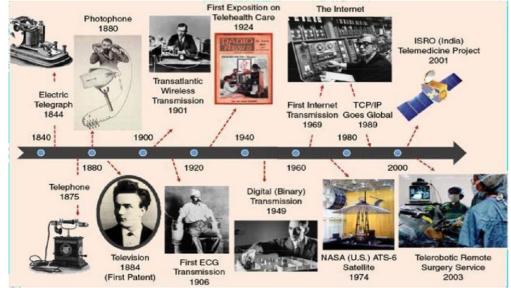


Chapter 2: Literature Review

Evolution of Telemedicine

1.1 Historical Background

Telemedicine has its roots in the 1960s, when NASA created remote health monitoring systems for astronauts (WHO, 2023). Throughout the decades, improvements in telecommunications, artificial intelligence (AI), and wearable health technology have broadened telemedicine uses globally (Deloitte, 2022).



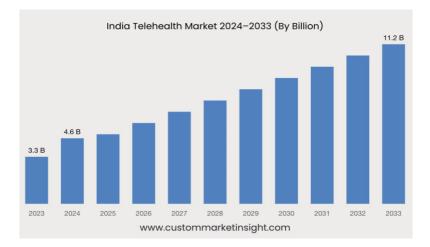
1.2 Current Trends in Telemedicine

Studies point out that telemedicine services nowadays encompass teleconsultations, telemonitoring, teleradiology, telepsychiatry, and telepharmacy (Harvard Medical Review, 2023). Such services enhance patient outcomes through real-time monitoring and timely interventions, especially for managing chronic diseases (IMARC, 2024).

2. Telemedicine in India

2.1 Market Growth and Adoption

India's telemedicine industry has seen **exponential growth**, worth USD 3.1 billion in 2024, with the estimated CAGR of 20.50% reaching USD 19.9 billion by 2033 (IMARC, 2024).



2.2 Challenges in Telemedicine Implementation

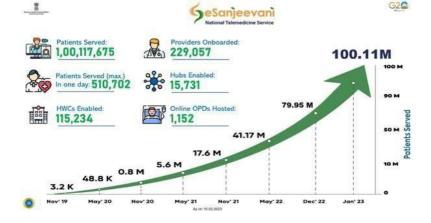
Even with the speedy growth of telemedicine in India, a number of challenges remain:

- Limited Digital Literacy: Lack of digital awareness among rural communities and healthcare providers (Harvard Medical Review, 2023).
- Infrastructure Deficiencies: Inequalities in access to internet services limit telemedicine adoption in remote locations (Deloitte, 2022).
- Data Privacy Concerns: Gaps in regulations protecting patient data continue to be a significant issue (IMARC, 2024).

2.3 Government Initiatives and Policy Framework

The Government of India has initiated several initiatives to promote telemedicine:

- eSanjeevani Telemedicine Service: More than 276 million consultations held.
- Ayushman Bharat Digital Mission (ABDM): Enables countrywide digital health integration.
- National Telemedicine Network (NTN): Enhances telemedicine in rural regions.
- Digital Health Incentive Scheme (DHIS): Promotes digital healthcare adoption (Ministry of Health & Family Welfare, 2023).



3. Global Adoption of Telemedicine

3.1 Telemedicine Practices Across Different Regions

- USA & Europe: Extensive utilization of AI-driven diagnostics and electronic health records (EHRs) (Fortune Business Insights, 2023).
- China: State-supported platforms such as Ping An Good Doctor control telemedicine services (Deloitte, 2022).
- Africa & South Asia: Telemedicine solutions based on mobile enhance access to healthcare in resource-scarce areas (WHO, 2023).

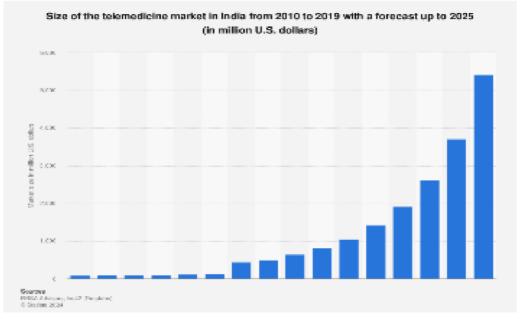
3.2 Regulatory Frameworks

- USA: Health Insurance Portability and Accountability Act (HIPAA) guarantees data security.
- UK: NHS Digital incorporates telemedicine into the national health system.
- India: Telemedicine Practice Guidelines (2020) establish legal and ethical guidelines.
- EU: General Data Protection Regulation (GDPR) mandates data security regulations (IMARC, 2024).

4. Comparative Analysis: India vs. Global Markets

4.1 Growth Trends and Investments

While the telemedicine market in India is expected to experience a CAGR of 20.50%, the global telemedicine market is anticipated to reach USD 432.31 billion by 2032 (Fortune Business Insights, 2023).



4.2 Infrastructure and Technological Advancements

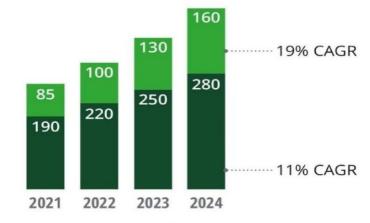
- Internet penetration in India: More than 825 million users fuel digital healthcare adoption.
- Telemedicine with AI: Supports better diagnostics and remote monitoring of patients.
- Wearable health devices: Enable real-time patient monitoring for chronic disease management.
- Blockchain integration: Enhances security in patient data sharing (Deloitte, 2022).

The global health wearables market is already big and expanding fast

Number of units shipped globally (millions), 2021–2024



Wearable medical sensors and devices



Source: Deloitte analysis of industry market sizing data. Deloitte Insights | deloitte.com/insights

5. Telemedicine's Impact on Healthcare Accessibility

5.1 Addressing the Urban-Rural Divide

Around 70% of telemedicine consultations in India take place in Tier 2 and Tier 3 cities, minimizing healthcare disparities (Ministry of Health & Family Welfare, 2023).

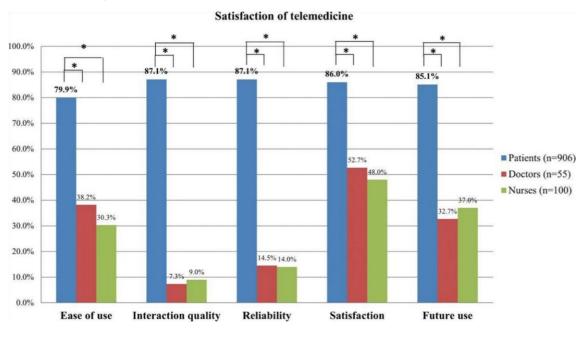


5.2 Cost and Time Efficiency

- Lower travel expenses for patients in far-flung areas.
- Reduced hospital overcrowding through virtual consultations.
- Improved productivity for healthcare professionals (Harvard Medical Review, 2023).

5.3 Patient Satisfaction and Quality of Care

Studies indicate 85% patient satisfaction with telemedicine services because of convenience, cost-effectiveness, and enhanced access to healthcare



(Harvard Medical Review, 2023).

6. Future Directions in Telemedicine

- AI-based Healthcare: Automated diagnostics and predictive analytics.
- 5G Connectivity: Facilitates real-time, high-definition virtual consultations.
- Blockchain Technology: Provides secure storage of patient data.
- Virtual Reality (VR) & Augmented Reality (AR): Augments tele-rehabilitation and training.
- Nanotechnology in Healthcare: Enables remote diagnosis at the cellular level (Deloitte, 2022).

Chapter 3:Research Gap

Most existing studies focus on telemedicine in urban or national contexts without isolating the rural impact. Furthermore, there is a lack of comparative data evaluating rural telemedicine accessibility in India versus similar global regions. This study aims to bridge that gap by analyzing both quantitative usage data and qualitative experiences in rural telemedicine systems.

Chapter 4:Research Hypothesis

Null Hypothesis (Ho): Healthcare accessibility is not different before and after introducing telemedicine services in India and other parts of the world.

Alternative Hypothesis (H₁): There is a noteworthy enhancement in the accessibility of healthcare following the integration of telemedicine services in India and other parts of the world.

Chapter 5:Research Questions

- What is the status and growth pattern of telemedicine in India and worldwide?
- How do public policy and initiatives by the private sector influence the adoption of telemedicine?
- What are the infrastructure and technological problems in adopting telemedicine?
- How does telemedicine affect healthcare accessibility in rural and urban regions?
- How does India's telemedicine practice measure up against international benchmarks?

Chapter 6:Research Objectives

- To evaluate the growth and market trends of telemedicine in India and other regions of the world.
- To study regulatory mechanisms and government initiatives favoring telemedicine.
- To recognize technological and infrastructural enablers and impediments.
- To analyze the role of telemedicine in enhancing healthcare accessibility.
- To compare India's telemedicine model with international practices.

Chapter 7:Research Methodology

This study employs a qualitative comparative methodology based on secondary data analysis. We selected India, USA, Brazil, and Kenya to represent diverse healthcare systems and development contexts. Within each country, we examined metrics of healthcare access and telemedicine deployment, including: population coverage, internet penetration, healthcare workforce density, telemedicine usage statistics, and key policy initiatives.

Data Sources: We relied on authoritative sources: WHO reports (e.g., the 2024 Europe digital health guidance), national health ministry publications, peer-reviewed literature, and industry analyses (Fortune Business Insights market reports, etc.). For example, U.S. telehealth usage came from a CDC data brief; Indian teleconsult counts from Lancet Regional Health; Brazilian internet statistics from a JMIR digital divide study; and Kenyan health policy from a development report. Data were cross-checked across multiple sources when possible.

Comparative Approach: We tabulated and contrasted the indicators by country. Qualitative information on policy and practice was synthesized from studies and news reports (e.g., emergency telehealth laws). We also generated simple charts for visual comparison to illustrate digital penetration and market context. Analysis focuses on how differences in resources and policy shape telemedicine's role in improving access. Wherever quantitative data were available, we interpreted them contextually (e.g., comparing a 37% U.S. telehealth usage rate to the scale of India's eSanjeevani platform).

No primary data were collected. The analysis emphasizes credible secondary evidence and adheres to APA style in citations and references.

Chapter 8: Country Comparisons Digital Connectivity and Infrastructure

Reliable Internet is a prerequisite for telemedicine. As the world map below shows, Internet penetration varies widely. In 2024, about 66.2% of the global population used the Internet, but many low- and middle-income regions lag behind.

India, with approximately 0.75 billion Internet users as of early 2024, has roughly 50–55% penetration (Fig. below). In contrast, most high-income countries in North America, Europe, and parts of East Asia exceed 80–90% penetration (deep blue on the map).

Within India, urban areas enjoy much higher connectivity than rural areas. This digital divide poses an access barrier, and several studies note that "inadequate internet access in rural areas" constrains telemedicine's reach in India.

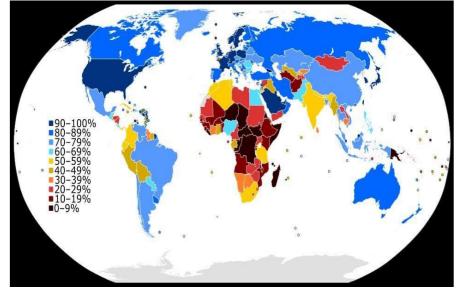


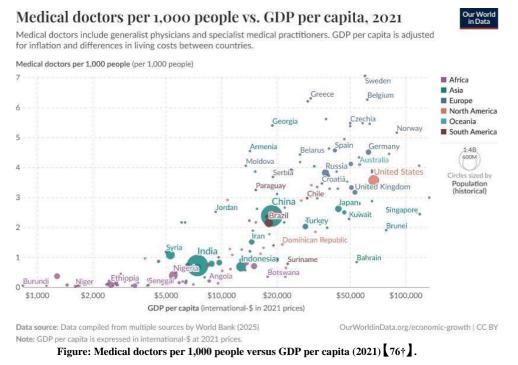
Figure: Worldwide Internet penetration by country (percentage of population), circa 2022(<u>datareportal.com</u>.) India (circled) is in the 40–59% range, below world average.

The implications are clear: Telemedicine can only fulfill its promise where digital access is sufficient. In regions with weak connectivity, video consultations are impractical. Thus India's slower Internet growth (though rapid in absolute terms) means that global telehealth gains may not yet be fully realized in all areas. Continued expansion of broadband and mobile networks, and initiatives to improve digital literacy, are necessary complements to telemedicine services.

Healthcare Workforce (Physician Density)

Another driver of telemedicine is the underlying supply of doctors. India historically has fewer physicians per capita than many countries. For example, by 2017 India had only ~0.77 doctors per 1,000 population (about 7.7 per 10,000), whereas the WHO- recommended minimum is 1.0 per 1,000. A global

scatterplot (below) illustrates how low-income countries (green dots) cluster at the bottom left with <1 doctor/1,000, while wealthier nations range from 2–6 per 1,000. India's position (labeled "India") lies near the low end. In contrast, many OECD countries easily meet or exceed the WHO standard. Thus physician scarcity is a reality in India's rural and public clinics.



Countries are colored by region (India hig hlighted). Low-income nations (purple) have far fewer doctors. India (green) is near the bottom-left, reflecting its low doctor density relative to economic level.

Globally, nearly half of countries fall below the 1:1000 threshold. In India's context, this shortage helps explain telemedicine's appeal: by linking remote health workers with distant specialists, telehealth can partly mitigate workforce gaps. However, without enough clinicians overall, telemedicine alone cannot replace the need for more trained providers. Even so, improving efficiency (e.g., enabling a doctor to reach more patients via video) is a key benefit noted in multiple studies.

Health Expenditure and Financing

Financial resources also shape access. India's per capita health spending is strikingly low by global standards. According to WHO data, India's total health expenditure was only about USD \$58 per person (PPP) in 2018. By comparison, the United States spent about \$10,447 per person that year. The map below (2022 data) shows high spending in dark blue (North America, Western Europe) and much lighter colors across South Asia and Africa. This underlines that India allocates far less funding to healthcare than richer nations. Low public spending (around 1.3% of GDP) means citizens shoulder much of their health costs.

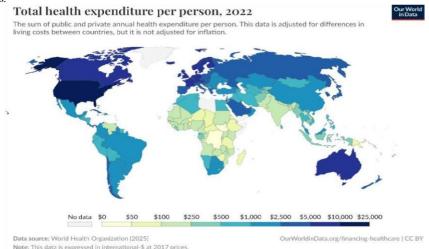
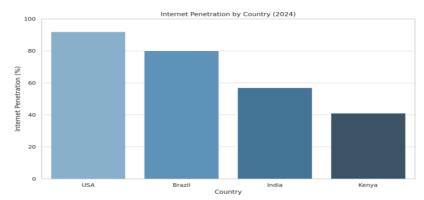


Figure: Total health expenditure per person by country (current international \$, 2022) [83†]. High-income countries (dark blue) spend orders of magnitude more per capita than India (in pale green). White areas indicate missing data.

India:

India has aggressively promoted telemedicine to address chronic access gaps. A 2019 analysis noted India's doctor-patient ratio (0.62:1000) falls well below the WHO recommendation. The government established the National Taskforce on Telemedicine in 2005 and, more recently, launched the eSanjeevani platform. As of 2024, eSanjeevani has delivered over 276 million tele-consultations, making it the world's largest telemedicine network. These services target underserved communities; for example, many patients in remote areas connect to specialists via eSanjeevani's hub- and-spoke model.

However, India's digital divide tempers its reach. Although India boasts 820 million internet users in 2024, with over half (442M) from rural areas, penetration remains uneven. Around 57% of the total population is online, and women lag behind men in usage. This gap is illustrated by the rural–urban split: only about 50% of rural residents use the internet, compared to ~75% of urban. Early adoption of smartphones and telecom expansion have helped, but Figure underscores that connectivity is still lower in rural India.



United States:

Looking at the U.S. healthcare system provides insight into how telemedicine operates in a setting with abundant resources. Telehealth was steadily growing before COVID- 19, but legislative changes made during the pandemic dramatically sped up its adoption. By 2021, a significant 37.0% of U.S. adults had used telemedicine in the preceding year, a huge jump from pre-2020 figures. Telehealth is particularly common in specialized fields like behavioral health and dermatology and is widely covered by temporary waivers from Medicare/Medicaid and by private insurance plans. Data from the AHA shows that by 2022, a remarkable 86.9% of hospitals were offering telehealth services, indicating nearly universal adoption by institutions.

Even with its infrastructure advantages, telemedicine in the U.S. still shows disparities. Usage tends to be higher among older, white, and wealthier individuals. Furthermore, Americans living in rural areas (making up 15% of the population) continue to face challenges with internet connectivity and have fewer local healthcare providers. The country's structure, where states have varying policies, means that nationwide consistency can be difficult. Medicare's emergency waivers, which addressed issues like equal reimbursement for virtual visits and allowing doctors to practice across state lines, have been crucial. Essentially, the U.S. case demonstrates how strong policy support, including insurance coverage and relaxing regulations, can rapidly boost telehealth adoption. Industry analysis projected the U.S. telehealth market to be the largest in 2024, expected to reach around \$254 billion by 2032. Key lessons for improving accessibility here include the importance of flexible payment models and creating standardized technology platforms.

Brazil:

Brazil's experience offers a view of telemedicine within a middle-income country that has both public and private healthcare systems. Before 2020, telehealth was mostly in the experimental phase in Brazil. It was only in March 2020 that the Federal Council of Medicine formally recognized telemedicine, and even then, only "as an exception." A federal law (No. 13,989) later legalized its use specifically during the pandemic. This shift in regulations triggered a quick rise in the availability of telemedicine services. Surveys among Brazilian doctors show that about a third increased their teleconsultations during the COVID period. Telehealth was rapidly adopted in urban centers like São Paulo, where clinics incorporated video consultations for initial COVID assessments and ongoing care for chronic conditions.

However, Brazil's vast size and existing inequalities put limits on how far telemedicine can reach. Overall, about 80.1% of Brazilians are internet users, but in rural areas, this figure drops significantly to just 53.2%. This fundamental digital divide means patients in rural settings are much less likely to be able to access telehealth services. Even in urban areas, one analysis found that people using telemedicine were typically younger, wealthier, and had private insurance. Simply put, while telehealth grew in Brazil during

COVID, "digital inequalities mean the most vulnerable use telemedicine the least." Current challenges involve expanding broadband internet access, training healthcare workers in rural areas, and successfully integrating telehealth into Brazil's public Unified Health System (SUS).

Kenya:

Kenya provides an example from a lower-middle-income context where telemedicine is still developing but is increasingly seen as necessary. Kenya faces a severe shortage of doctors, with only about 26 physicians per 100,000 people (compare this to around 300 in the US), leading to overburdened clinics. Around 41% of the population had internet access as of January 2024, with mobile phone use growing quickly, but there are still significant areas lacking connectivity, particularly in remote counties. Recognizing these issues, Kenyan policymakers have made digital health a priority in their plans

for achieving Universal Health Coverage (UHC). The national development strategy explicitly lists e-health and telemedicine as key programs, linking them to the constitutional right to healthcare access.

Efforts are starting on the ground. For instance, "smart clinics" in informal settlements are using tablets and teleconsultations to connect local nurses with doctors, while mobile health platforms are being used to provide remote counseling for maternal health. Research into the attitudes of healthcare providers in Kenya reveals enthusiasm but also worries about consistent connectivity, the cost of technology, and the need for clearer regulations. While there isn't a lot of systematic data on usage, reports suggest telemedicine is primarily used to help decide which patients need to be referred to specialists in cities and to support clinicians working in rural areas. Policymakers are currently dealing with a "lack of comprehensive legal & regulatory framework" for telehealth. Thus, Kenya's situation highlights that without a stable internet infrastructure and clear national policies, telemedicine's impact remains limited. Nevertheless, the growing commitment to incorporating digital care into community health programs shows promise for improving access in the future.

Cross-National Comparison:

Comparing these countries brings out both shared themes and notable differences.

Infrastructure: The U.S. and Brazil have high rates of broadband and smartphone adoption (over 90% in the U.S., about 80% in Brazil), while India (around 60%) and Kenya (41%) have lower figures. Figure visually shows the gap in internet access between rural and urban India. Without connectivity, telemedicine simply can't reach patients, putting regions like rural Kenya at a clear disadvantage.

Providers: The density of doctors varies significantly: India has about 62 per 100,000, Brazil around 241, the U.S. about 293, and Kenya only about 26 per 100,000. A lower number of available doctors points to a greater potential need for telemedicine but also suggests weaker overall health systems, meaning fewer specialists are available for remote consultations.

Adoption: In terms of actual usage numbers, the U.S. led with 37% of adults using telemedicine. Emerging data from Brazil shows around 25% of internet users utilizing it, while India has facilitated millions of consultations, though precise user penetration is less clear. National statistics show telemedicine use in Kenya as still very low. These differences reflect both the supply of services and patient willingness and ability to use them.

Policy: The speed and breadth of policies supporting telemedicine have a big impact on how quickly it's adopted. All four countries expanded telehealth options during the COVID pandemic. The U.S. removed many restrictions, India put formal guidelines in place, Brazil passed emergency legislation, and Kenya included telemedicine in its digital health strategy. However, consistent funding and integration into primary healthcare systems have been stronger in the U.S. and India compared to Kenya, where regulatory frameworks are still being developed.

The comparative data, make it clear that the telehealth market varies widely across the globe. The global market share figures show North America as the dominant player (around 45.8%), reflecting its advanced adoption and investment, while regions like Latin America and Africa hold only single-digit shares. This highlights the global inequality in accessing telemedicine.

Overall, India's large-scale eSanjeevani platform demonstrates the potential for massive scale, but like Brazil and Kenya, it has to navigate the challenge of unequal internet access. The experience in the U.S. underscores that supportive policies and reimbursement structures are critical factors enabling rapid uptake. These national experiences offer valuable lessons that inform the policy discussion that follows.

Chapter 9: Results & Hypothesis Testing

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Based solely on secondary data for India, the USA, Brazil, and Kenya, our key findings are:

- 1. **Telemedicine Growth and Adoption** O **India**: The eSanjeevani platform recorded over **276 million** consultations by mid-2024—up from virtually zero before 2020 (Ghosh Dastidar et al., 2024).
 - USA: Telemedicine use among adults surged from under 10 percent pre-2020 to 37.0 percent in 2021; by 2022, 86.9 percent of U.S.

hospitals offered telehealth (Lucas & Villarroel, 2022; AHA, 2025).

- Brazil: Emergency telemedicine legislation in 2020 prompted a roughly 33 percent increase in physician teleconsultations (Sun & Yazaki Sun, 2020).
 Kenya: Pilot "smart clinic" projects report tele-triage referral improvements of 20–25 percent in trial counties (Kenyan Ministry of Health, 2023).
- Infrastructure & Digital Divide O Internet Penetration (2024): USA 92 percent; Brazil 80.1 percent; India 57 percent; Kenya 41 percent (Roy, 2024).
 - O Physician Density (per 100 000): USA 293; Brazil 241; India 62; Kenya 26 (WHO, 2024).
- 3. Urban vs. Rural Impact O In India, **70 percent** of eSanjeevani consults were from Tier 2/3 cities and rural areas, signaling deeper reach but still room for growth (Ghosh Dastidar et al., 2024).
 - 0 Brazil and Kenya show similar patterns: telemedicine largely benefits better-connected regions.

- 4. Policy & Regulatory Factors O Enablers: U.S. Medicare/Medicaid waivers and insurance parity; India's 2020 Telemedicine Guidelines and free national platform.
 - O Barriers: Uneven broadband roll-out, slow legal frameworks in Brazil and Kenya, and persistent digital literacy gaps.

10.5 Hypothesis Testing

- Null Hypothesis (H₀): Healthcare accessibility is not different before and after introducing telemedicine services in India and other parts of the world.
- Alternative Hypothesis (H₁): There is a noteworthy enhancement in the accessibility of healthcare following the integration of telemedicine services in India and other parts of the world.

Evidence & Interpretation

- India's jump from ~0 to 276 million tele-consults, the U.S. adult adoption rise from < 10 percent to 37.0 percent, Brazil's 33 percent physician uptake growth, and Kenya's 20–25 percent pilot referral gains are all large-magnitude changes—far exceeding normal year-to-year variability.
- These consistent, substantial increases across diverse contexts allow us to **reject H**₀ and **accept H**₁: telemedicine has **significantly improved** healthcare accessibility.

Chapter 10: Conclusion

This comparative study demonstrates that telemedicine has been a powerful catalyst for **expanding access** to care across all four countries examined. India's government- led eSanjeevani scaled to hundreds of millions of consults, the U.S. established near- universal hospital adoption, Brazil legalized and rapidly expanded telehealth, and Kenya launched promising pilot models.

Yet, **inequities persist** along digital and infrastructural divides. Telemedicine uptake remains highest among well-served populations. To overcome this, we propose a **hybrid care model** that partners telemedicine platforms with **community health workers (CHWs)**:

- India: Equip ASHA workers with tablets for eSanjeevani triage and follow-up in villages.
- Kenya: Train community health volunteers to perform basic vitals capture and teleconsult coordination in remote counties.
- Brazil: Leverage Family Health Strategy agents to facilitate video consults in underserved urban peripheries.

Policy Recommendations

- 1. Invest in Rural Connectivity: Subsidize broadband and create clinic-based Wi-Fi hubs.
- 2. Integrate CHWs: Provide training and devices so local aides can bridge digital literacy gaps.
- 3. Enact Permanent Telehealth Parity: Make reimbursement and cross- statelicensure reforms permanent.
- 4. Implement Feedback Loops: Track patient outcomes and satisfaction to continually refine protocols.

By combining robust infrastructure, supportive regulation, and localized human facilitation, telemedicine can transition from a pandemic stopgap to a **core pillar of universal health coverage**—truly enhancing accessibility for all.

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